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HOG PRICE DIFFERENTIALS BETWEEN SELECTED IOWA MARKETS

by

John Marvin Skadberg

A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Major Subject: Agricultural Economics

Approved:
Signatures have been redacted for privacy.

Iowa State University
Of Science and Technology
Ames, Iowa

1964

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INTRODUCTION

This study was designed to examine several methods and markets Iowa producers have available to market their hogs. A comparison was made of the returns producers receive using several different methods and markets. Since there are both different methods and markets available to Iowa producers, it might be helpful to trace the development of hog marketing both in Iowa and the United States.

Production and marketing of hogs is a major farm enterprise in Iowa. In 1963, Iowa farmers marketed more than 19.7 million head of hogs (51). Cash receipts received by Iowa producers from hogs in 1963 accounted for 26.8 percent of their total cash receipts (50). Therefore, a study which may improve the methods of marketing hogs would be important to Iowa hog producers, even small gains in hog marketing efficiency could contribute substantially to farm income.

History of Hog Marketing

Hog marketing in the United States and particularly in Iowa has undergone many changes since hogs began to contribute substantially to agriculture income. During the early development of our country, the marketing of hogs and all agriculture products was a relatively simple operation. A large proportion of the hogs that were produced were consumed on the farm by the producer, even at this early stage of our

country's development certain portions of the hog were cured and shipped to more distant consumption areas. Those hogs that were not consumed at the farm were slaughtered in and for the local community, but the number slaughtered off the farms were extremely limited.

As the railroads began extending Westward, in about 1850, they were used quite extensively for shipment of live hogs from surplus production areas to deficit production areas (47). A short time later, about 1870, refrigerated railroad cars were developed, this made it possible to ship meat instead of only live animals. These developments contributed to the growth of a national meat market, as contrasted to the limited local markets prior to that time.

With the development of a national market, pork production in the more Western states, particularly the Corn Belt, began to increase rapidly. In 1850, only three counties in Iowa had over 50 hogs per square mile (4). In 1962, there were only 18 counties with less than 50 hogs per 100 acres of cropland and 37 counties with more than 75 hogs per 100 acres of cropland.

The increase in hog production led to the development of more complex marketing systems. The marketing systems were more complex systems than those employed when only local markets were involved. Since most of the hogs during the early development of a national market had to move by rail, packing plants located near or at the rail centers. The

location of many packing plants at rail centers caused some unique methods of marketing livestock, these were the terminal markets. About 1850, terminal markets began to evolve as the primary method of marketing hogs, cattle, and sheep. The terminal markets, with their established yard facilities, made it possible to concentrate hogs from many outlying production areas. The first terminal yards were owned by the railroads. Later these terminal facilities were purchased jointly by the major packing companies and made an integral part of packing plant operations. They kept control of these facilities until the Packers' Consent Decree of 1920 which forced the packing companies to divest of their interest in the stockyard companies (4).

Chicago, at this time, was the largest meat packing center in the United States. Chicago's prominence in the meat packing industry was primarily due to location, located at a major railroad center and located geographically between the Midwest hog producing area and the consumption centers of the East.

Later, as hog production moved Westward, other terminal yards were developed at St. Paul, Omaha, Kansas City, St. Joseph, St. Louis, and Sioux City. These new centers of livestock concentration made it more convenient for producers in the more Western areas to market hogs.

During the early period of national markets, terminal

yards or markets provided a worthwhile function of concentrating both the buyers (packing plants) and sellers of hogs at a given location. The hogs after being concentrated and marketed were slaughtered in nearby packing plants and finally the meat was shipped East to the deficit producing areas which were the main consuming centers.

The freight rates, during the early history of national markets, made it economically feasible to ship meat, rather than livestock, east to the consuming centers. The decline of the packing industry in the primary consumption centers was caused by the freight changes which favored the shipment of carcasses rather than live animals.

It was more economical to slaughter the hogs in the production centers and ship only carcasses or wholesale cuts to the consumption centers for distribution.

About 1889 freight rates changed, again making it profitable to ship live animals east for slaughtering. But the freight change was only temporary and by 1890 it was again more economical to slaughter livestock in the production areas and ship the meat east. There have been many fluctuations in freight rates since 1890, however, the direction of freight rate changes generally has favored shipment of meat to the consuming centers rather than shipment of live animals to slaughtering plants located in consuming centers.

About 1890, independent packers located in interior Iowa

began to enlarge their packing plants. The freight rate advantage and lower procurement costs speeded the development of interior Iowa packing plants. The rapid growth of interior packing plants in Iowa attracted the attention of the national packers. They became interested in setting up packing plants in interior Iowa to compete with these new plants. Traditionally, the national packers had built their plants at the terminal market centers. The growth of the interior located packing plants caused different hog marketing patterns to develop. Previously, most Iowa hogs were marketed through terminal yards, now they began to move in much greater proportions direct to packing plants.

Interior Marketing of Hogs Increases

Some of the advantages that interior plants had over terminal based plants were: (1) the freight rate advantage of shipping carcasses rather than live animals, (2) the labor and other plant costs were slightly lower outside large metropolitan centers, and (3) the hog procurement costs were lower. The interior packers located their plants in concentrated hog production areas.

Hog producers were attracted to marketing at interior plants because it reduced transportation costs, shrinkage loss and marketing costs.

A portion of the reduction in marketing cost was offset

by lower hog prices but not enough to discourage the shift to direct marketing.

The typical hog producer, during this period, had only a small number of sows and farrowed only once or twice a year. Therefore, most producers had insufficient numbers of slaughter hogs ready to market at one time. However, with the advent of direct marketing, a producer could top out his hogs as they became ready for market. He could reduce his transportation cost by combining hog marketing with a normal shopping trip to town. The cost of transporting hogs to market, in this case, would be extremely small.

Table 1 shows that the proportion of hogs going to terminals has declined while those going direct to plants has increased.

Table 1. Destination of slaughter hogs in Iowa

Year[a]	Public yards (%)	Direct to Packing plants or dealers (%)	Other methods (%)	Source
1920	67.4	19.7	12.2	4
1925	62.7	27.3	10.0	4
1930	38.6	39.4	22.0	4
1933	30.0	65.0	5.0	47
1940	20.2	56.7	23.1	7
1954	14.4	83.0	2.6	24

[a]Data not available for years other than those listed.

The expansion of meat of independent meat facilities in interior Iowa caused reduction in number of hogs shipped to terminal markets. A reduction in flow of hogs to terminal markets also reduced the flow of hogs to terminal based packing plants. To counteract the decreased slaughtering at their terminal based plants, national packers, who had traditionally dominated the meat packing business, began to both build and purchase packing plants in interior Iowa and southern Minnesota.

The increased numbers of interior located packing plants caused an increase in the proportion of hogs marketed direct to packing plants.

The growth of direct marketing and the bypassing of terminal markets added more complexities to the job of marketing hogs. After this change, a producer was no longer assured that all competitors, for his hogs, would be located at the same market. Before direct marketing became a significant factor in the market, terminal markets were the primary price registering point for live hogs. Hence, prices reported by central markets gave producers sufficient information to determine when or where they should market their hogs. But hog marketing became more complex when many more outlets were available. The producer, in order to assure himself of an equitable price for his hogs, had to personally contact packing plants, packer buyers buying stations, and

others before marketing his hogs. He also had to study and keep current on the terminal markets to keep abreast of the total price picture.

In an attempt to collect some of this new price information, the U. S. Department of Agriculture Crop and Livestock Reporting Service began in 1931 to gather data from the interior Iowa and southern Minnesota packing plants. However, these data were less reliable than the original terminal market data. The terminal market prices were recorded by unbiased U. S. Department of Agriculture reporters while the interior reports were based on a packer employees estimation of the day's prices.

Another factor which complicated hog marketing as direct marketing enlarged was that many packing plants introduced new methods of evaluating hogs. One of these new methods was evaluating each hog on a basis of grade and weight of a particular hog. The producers were then paid on the total evaluation of each hog. The general method used previously, both at terminal markets and packing plants, was to buy an entire lot on a one price basis, this was called buying on a mixed basis.

The increased numbers of prices, since the grades were not comparable in all cases, required a much more complex reporting system than the one in use. It was practically impossible to report all these prices on the radio or in the newspapers.

Another method introduced by some packing plants about 1950 was carcass yield and grade, thus adding further to the choice of selling methods. Hogs purchased by carcass grade and yield method were not evaluated live. They were evaluated only after the hogs were slaughtered and hung in the cooler. Carcass grade and yield buying also decreased the value of live price quotations and required the producer to analyze more factors before selling his hogs.

To increase the marketing complexity even more, new packing plants are continually being established in the main hog producing areas, hence more markets available to producers. These new plants increase the number of outlets available to Iowa producers, but do not help clarify the price structure of the market.

The following chapter will specify the types of markets, the major methods of marketing and some of the features of each.

TYPES OF MARKET OUTLETS AND METHODS OF MARKETING HOGS

Types of Outlets

Terminal market

There are about eight terminal markets located within reasonable distances to be available to some Iowa hog producers. They are Sioux City, Iowa; Omaha, Nebraska; Sioux Falls, South Dakota; St. Joseph, Missouri; Kansas City, Missouri; St. Louis, Missouri; St. Paul, Minnesota; and Chicago, Illinois. Not all farmers in Iowa have alternatives to each of these markets but each market is within a reasonable hauling distance to a portion of Iowa's producers.

Terminal markets are those markets which offer hog producers specialized selling services. The terminal markets are organized into two separate entities -- the stockyard company and the commission firms or exchange division. The stockyard company owns the yard and facilities, they rent these facilities to individual commission firms. It is the commission firm's responsibility to sell livestock for the farmer customers. Livestock sent to the terminal yards are consigned to the commission firm which, in turn, sells them to the various livestock buyers. However, livestock can be sold by the producer himself if he chooses. Most hogs sold through terminal markets are sold to packing plants for slaughter. It is the commission company's responsibility to

to obtain the highest price possible for each particular producer's hogs. The stockyard company, in most cases, handles the feeding and care of the animals. This cost is either charged to the commission firm or the producer consignee.

Hogs sold through the terminal are received at the yards, consigned to a commission firm and then unloaded and driven into pens assigned to that commission firm. Hogs are given feed and water if held over night or were hauled a long distance. If the hogs arrive too late for a particular day's sale, the hogs are held over and sold the next morning. Immediately after the sale price has been established, the hogs are weighed to estimate the return due the producer. Ideally, hogs of a particular shipment, that consists of varying grades, should be sorted into various grades before selling. That is, hogs should be graded so different prices could be determined for each different grade in the shipment. Actually, this is seldom done. Usually, a price is placed on the total lot. A producer generally receives only an average price for the entire lot of hogs. However, if there are some animals which are extremely different from the rest of the lot, these hogs are priced separately.

Farmers selling on the terminal market must adjust their gross returns by the cost of using this type of selling service. If producers desire specialists to sell their hogs,

then they must be willing to pay for the price of this service.

The cost of marketing hogs at a terminal yard includes:

1. The cost of transporting the hogs to market, which includes insurance during transit.
2. Gross return should be adjusted by the loss in weight during transit, loss that is in excess of what might be regained from feeding and watering at the market before sale.
3. Yardage fee is charged for handling the feeding and handling of the livestock at the market.
4. Commission charge, this is cost charged by commission firm for the service of selling the hogs.
5. Miscellaneous fees, yard inspection, meat board, etc.

As mentioned earlier, hogs sold through the central terminal markets are usually sold on a mixed basis, that is, an average price is computed for a shipment of hogs. There is a minimal of sorting done presently at most terminal markets. Most Iowa farmers are located farther from terminal markets than they are from their local markets, therefore, transportation costs to terminal markets are usually higher.

Before a producer can compare local market prices with terminal markets, the terminal market value must be adjusted downward by the additional amount of marketing charges which may be incurred.

Packing plants and packer buyer stations

Farmers can sell their livestock direct to many packing plants located in Iowa. There are about 35 to 40 packing plants of varying sizes buying hogs in Iowa. In addition to packing plants themselves, many of the larger packing companies have set up packer buying stations throughout the country. A buying station, operated by packer personnel, can usually buy hogs on the same basis as they are purchased directly by the plant. Most of the major packing plants in the state offer producers three different methods of selling their hogs. The producer must choose the method he desires to use selling his hogs. The following is a list of those methods and brief discussion of what they involve.

1. Mixed. This method of buying is very similar to most terminal market selling. An average price is determined for the entire lot of hogs, with no differentiation in price between the various grades contained in the lot of hogs. Sometimes, extremely poor quality hogs are priced separately under this method, but usually, there is only one price recorded.
2. Live sort. Using this method, the hogs of a lot are divided into categories similar to U. S. grades of No. 1 and No. 2 and No. 3, although individual packing plants may label them differently. Most

packing plant grades are fairly comparable to the U. S. Department of Agriculture grades. The hogs in each grade and weight category are priced separately. Producers can telephone packing plants before shipment to obtain the prices paid for each grade and weight on that particular day. Even though live grading may appear to be a more exact method of buying, in actual practice buyers often do no more grading under this method than they do when they are buying on a mixed basis.

3. Carcass grade and yield. This method, as stated earlier, evaluates the animal after it is slaughtered and the carcass is hanging in the cooler. Some packing plants apply a 2 percent shrink on these carcasses before estimating their value. Other plants allow carcasses to cool slightly then weigh and apply a 1 percent shrink before arriving at the pay carcass weight. The yield of meat is estimated and then multiplied by the wholesale value of the meat, then they subtract slaughtering costs and add the by-product value to arrive at a net value for the carcass. The yields of meat from a particular carcass are estimated by past experience with carcass evaluation of hogs of similar weight and grade.

One disadvantage of this method is that any

loss due to disease is most often absorbed by the producer. The producer is paid only on the amount of saleable meat obtained from his hogs.

A producer has a choice of delivering his hogs direct to the packing plant or to a packer buying station. Buying stations generally are located closer to the farm, thereby reducing both transportation costs and shrink loss.

There is an additional feature many packing plants offer to producers. Many packing plants pay bonuses for hogs shipped from producers that are located outside their immediate area. Packers indicate that higher prices for more distantly shipped is based on the fact that these hogs have lost more fill than those shipped only short distances. Many packers have clearly defined pricing areas.

When a producer delivers hogs to a buying station, the hogs are weighed at that buying station rather than at the packing plant. The packing plant absorbs the shrink and transportation cost from the buying station to the packing plant. However, there is very little tissue shrink during short hauls, so the actual cost of this service relatively small to the packer.

Concentration yards

Another type of market outlet for hogs is cooperative dealers who buy hogs from farmers. The cooperative sells the hogs to the packing plants where they can get the highest

return. A cooperative concentration yard collects hogs in one location, sorts and selects the hogs according to weight and grade. After sorting, the best market outlet is selected. A farmer frequently does not have enough volume to sort himself but it is profitable with large numbers of hogs. Cooperative firms after selling hogs, divide any net profit made from sorting among the members of the cooperative on a patronage basis.

Private dealers

Private dealers operate in almost the same fashion as cooperative concentration yards, the only difference being that the net profit, if any, is retained by the dealer rather than paid to the producer. Most hogs purchased by dealers are purchased on a one price bid for all the hogs of a given shipment. Some private dealers have agreements with packing companies where a packing company will take the hogs at a set fee, or the dealer may be a free agent, simply selling hogs to the best market outlet available.

Auctions

Very few slaughter hogs are sold through auctions, so no discussion of this method of selling livestock will be included.

Methods of Marketing

Producers must not only decide what method they will use to market their hogs. First, he must decide if he is to sell to a packer buyer, buying station operator, terminal market utilizing the services of a commission man, to a co-operative concentration yard or to a private dealer. But after selecting a given market or while selecting a market, the producer must decide how he should sell them, mixed, live sort, or carcass grade and yield. Most marketing specialists have contended that any one given method may be more profitable than the others at given times or with a given type of hog.

The producer is faced with making the above choices. What factors do producers have available to them that might aid in making the correct choice? The following factors can be used to assist the producer in making his choice of method and market.

1. The shorter the distance to market, the lower the transportation cost will be and the lower shrinkage enroute to market.
2. When selling to private dealers, packer buyers or to concentration yards, a producer can receive a specific price for his hogs, if they meet the specified standard. The producer can, if he contacts the market beforehand, know the price before

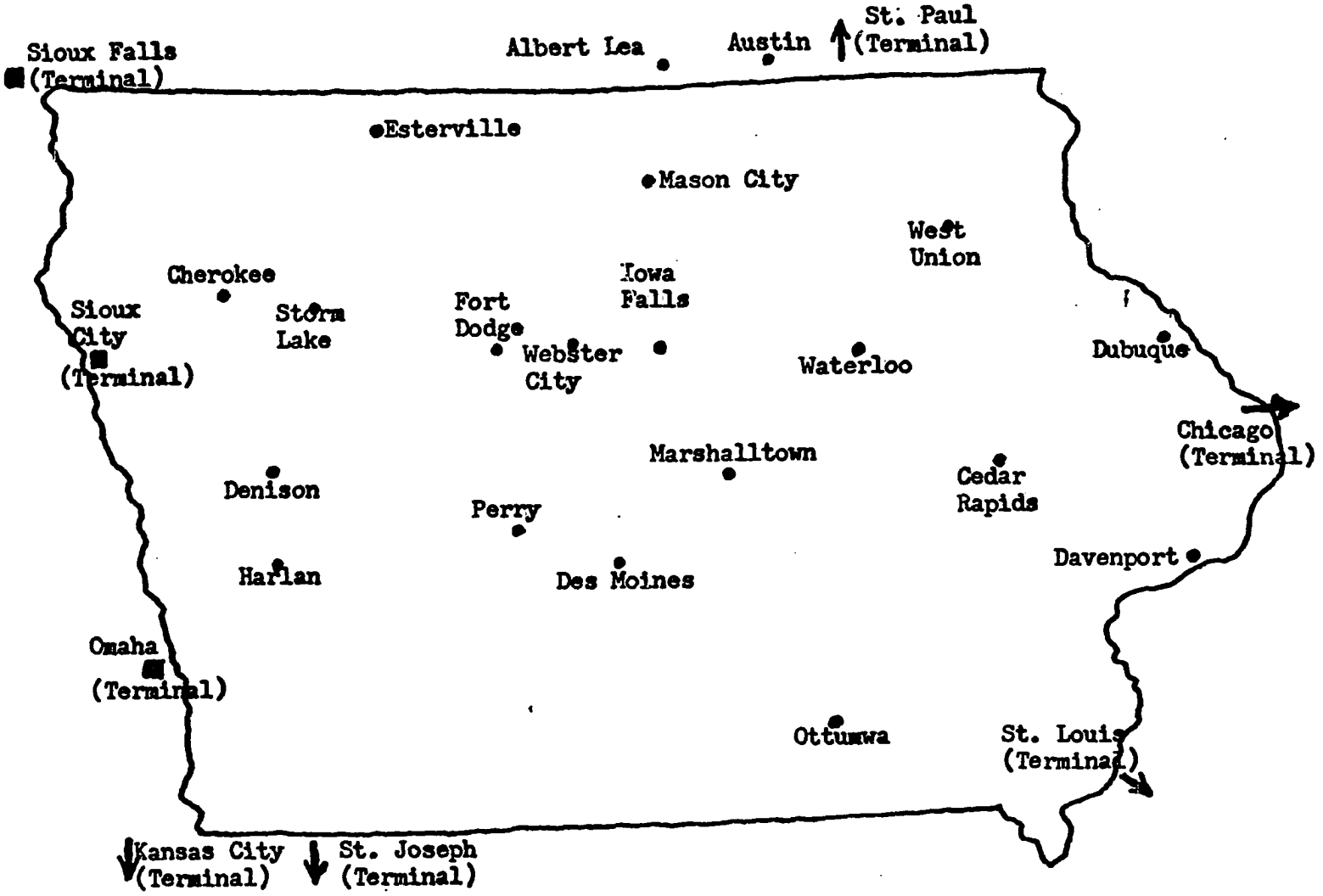
his hogs leave the farm. But if he sells through a terminal market, he must accept the going price for that day and he does not know beforehand exactly what it will be.

3. A producer selling through a cooperative concentration yard may receive an additional bonus if the concentration yard operator is successful in obtaining a higher than normal bid for the hogs consigned.

4. Many producers feel that terminals offer more competitive bidding than do other markets but this is not necessarily true. There are more visible buyers but this does not assure competition. But the producer does have the advantage of having a man selling his hogs that is in the market every day. The commission firm should be more knowledgable with the daily market than is the average producer, but the producer will have to pay a commission firm's services.

The primary locations of packing plants in Iowa and southern Minnesota are shown in Figure 1. There are many smaller packing plants located throughout the state but not shown. Also, there are many concentration points either handled by a packing plant, private dealer, auction or co-operative located throughout the area which may be an outlet for hogs.

Figure 1. Location of major hog slaughtering plants in Iowa and Southern Minnesota


Sioux Falls
(Terminal)
Albert Lea
Austin
St. Paul
(Terminal)
Esterville
Mason City
West
Union
Cherokee
Iowa
Falls
Sioux
City
(Terminal)
Storm
Lake
Fort
Dodge
Webster
City
Waterloo
Dubuque
Chicago
(Terminal)
Marshalltown
Cedar
Rapids
Denison
Perry
Davenport
Harlan
Des Moines
Omaha
(Terminal)
Ottumwa
St. Louis
(Terminal)
Kansas City
(Terminal)
St. Joseph
(Terminal)

PREVIOUS RESEARCH

This chapter will outline in chronological order some of the previous hog marketing research. In some of these studies the researcher attempted to determine price differentials between markets, other researchers' studies the entire hog marketing and hog slaughtering industry. Much of the more recent research was designed to determine how or why a producer would choose a particular market. At the same time, some research was directed toward finding a more accurate method of evaluating hogs.

The greater concern, shown by researchers in the last four decades, in hog marketing research can be contributed to the rise in direct marketing of hogs or the growth of interior Iowa packing plants. As direct marketing increased, producers were forced to choose between alternative market outlets. Research workers, recognizing the increased complexity producers faced, attempted to develop some helpful guidelines to hog marketing.

A series of studies conducted by the North Central Regional Livestock Research Committee examined all aspects of livestock marketing (29, 30, 32, 34). These studies will not be outlined, but they have contributed heavily to the livestock marketing body of knowledge.

A group of students, under the direction of Paul Miller, Iowa State University Professor, performed most of the early

studies in hog marketing.

One of these studies was "Hog Market Price Differentials" by Fitzgerald in 1925 (13). The purpose of his study was to specifically assist shipping association managers or individual shippers to select the best market alternative. This study took place during the time when there were essentially two alternatives open to these people; (1) to ship hogs to terminal markets, or (2) to ship hogs directly to eastern packing plants. He visualized three primary problem areas and decided to:

(1) Study the grade differentials in hog prices on some market and compare these differentials with like grade differentials in other markets.

(2) Study market differentials for the same grade of hog.

(3) Study the market differentials and grade differentials at county shipping points, taking into consideration both marketing expenses and freight rate variations.

Although Fitzgerald found grade price differentials during the period 1921-1924, he did not design any statistically sound theory to explain it. Each market, Chicago, Sioux City, Buffalo, Omaha, St. Paul, and St. Louis -- had different patterns of price differentials between grades. The price differentials appeared to be caused by seasonal vari-

ation in receipts, however, Fitzgerald did not test this. The data available at this time were inadequate for this type of testing.

In 1929, Hoffman (18), attempted to measure the price difference between interior marketing points and central terminal market. The growth of direct marketing which accounted for 50 percent of the hogs sold in Iowa prompted his study.

Two later studies, one by Quintus in 1931, and one by Mimms in 1934, examined the same problem as Hoffman (27, 36). Quintus' study examined the period prices 1925 for the central and eastern markets during the 1925-1929 period and the prices for interior markets during the 1926-1931 period. Whereas Mimms examined the prices of the same markets during the 1930-1934 period. Both of these studies lack precise hog price data. They both made adjustments in the data, to offset the interior price reporting discrepancy, but the adjustments were arbitrary and lacked rigorous research techniques. Despite the lack of precise techniques, a definite price trend could be observed. The interior market hog prices were approaching the price level of Chicago.

Cady, in 1933, gives an excellent history of the development of hog marketing in Iowa (4). He disputes the then prevalent hypothesis that direct marketing was a new phenomena in hog marketing. He traces the early development

of packing plants in Iowa. He presents such facts as Des Moines by 1840 has established a pork packing business, Davenport by 1842, Dubuque by 1845, Burlington by 1850, Muscatine had six packing plants before the Civil War, and he found that Keokuk had one of the earliest packing plants in Iowa. He also pointed out that by 1849 two cities in Iowa, Keokuk and Burlington, packed more hogs than did Chicago. Keokuk during the 1849-1850 period packed 19,000 hogs and Burlington 29,000 hogs, while Chicago packed only 11,900.

Cady documents that during the middle 1800's that hogs were marketed direct to merchant processors, to packers, or to consumers, without the use of intermediate middlemen. Therefore, Cady argues, direct marketing was not a new type of marketing that terminal marketing was of a more recent origin. He expands on the historical development of Iowa's pork industry by pointing out that by 1859 pork had become a staple product of Iowa. Not less than $1,500,000 had been paid out in the fall of 1859, in Iowa, to hog and as much more was kept for home consumption. Cady uses this statement to prove the importance of the hog industry in Iowa,

> Visit our river and railroad towns in the hog season and you have little else talked of than hogs. Go into the streets, and you see hogs; examine a railroad train, and you find the principal amount of freight and passengers to be hogs. Muscatine and Keokuk, two towns of less than one-sixth of the population of Cincinnati, the 'Porkopolis of the West,' have packed this year one-fourth the number of hogs which that renowned city has put up. The most obvious and ready means of converting our corn into cash, is by turning it to pork.

Cady adequately points out that direct marketing was not new and he, therefore, disputes such statements as those made by M. W. Bordus in 1929 (4, page 35).

> The issue is whether the present public, competitive markets, which have been used over fifty years, shall be preserved or whether the private system of marketing, without competition of Government regulation shall be substituted therefore.

Cady contends that central terminal marketing was only a temporary phenomena. That terminal markets were in the phasing out period. His estimates show that by 1932, two out of every three of Iowa's hogs were marketed at other than terminal markets.

Cady also argues against those who contended that there was no competition in direct marketing. Many people felt that the terminal markets set the prices and that when producers by-passed terminal yards they were weakening competition. His argument was that many people confuse price reporting and price determining. He felt that a price registering market was not necessarily the price making market.

In 1935, the U. S. Department of Agriculture released a study, Direct Marketing of Hogs, which examined the changes in hog marketing (47). This study examined the evolution of both direct and terminal hog marketing. It discusses the primary factors which caused the growth of the methods of marketing hogs. The authors also discussed the factors which determine the price level of hogs and how these factors changed over time.

The study attempted to determine if the growth in direct marketing of hogs had a detrimental effect on hog prices. The contention had been made, and is still made that interior packing plants maintain a constant price differential between their prices and terminal market prices.

To test if increased direct marketing had lessened competition for livestock, the authors assumed that the livestock marketing margin would increase. They measured the differences between live hog prices and wholesale pork prices in two periods. Direct marketing increased rapidly during the period 1920-1934. Hence, the authors felt that, by comparing marketing margins in 1920 with 1934, they could learn if a larger market share was being taken by packing plants during the latter period. There was a larger spread in the later period but the authors felt most of this could be attributed to higher labor costs, freight rates, and rents. The authors concluded this portion of the study by stating,

> Since these changes in marketing have affected retail prices of hog products and have not materially influenced the spread between hog prices and of hog products, it appears that the growth of direct marketing has little if any effect on the changes in the level of hog prices (4, page 137).

The authors also stated that

> It is probable that to a limited degree, the increase in direct marketing of hogs may have caused the spread between farm prices and retail prices of hog products to have been less than it would have been otherwise (47, page 137).

The researchers of this study tried to examine the price reaction of packing firms and terminal markets. To measure the price reaction, they assumed a price leader should change prices most frequently and should be the first to change its price. They tested the price reaction two ways, (1) lagging interior Iowa prices one day from Chicago terminal prices and (2) lagging Chicago one day from interior price changes. They found that when lagging interior Iowa plant prices one day from Chicago, the prices of both markets were in the same direction 32.9 percent of the time, but when lagging Chicago one day from interior Iowa, the movement of prices was in the same direction 41.7 percent of the time. The authors found that the interior or direct market buyers lead 41 percent of the time and terminals or Chicago led only 33 percent of the time. It would not be reasonable to assume terminals were the price leaders. Therefore, interior Iowa buyers advanced prices more often than did the Chicago terminal market (47, page 137).

The authors concluded this part of the study by stating that, "On the average the producer has received somewhat more for hogs marketed direct than he would have received if these hogs had been sold through the central public market," (47, page 201).

A 1938 study by Duddy and Reuzan (10), attempted to test essentially the same hypothesis as did the researchers of the above study, does direct marketing lessen competition.

Their approach to the problem was different than the previously discussed study. They computed the difference, in procurement costs, between the two methods of buying hogs plus the freight rate differentials between Chicago and the interior Iowa packing plants. The following table shows some of the results of Duddy and Reuzan's study.

Table 2 indicates that from September, 1937, to December, 1937, interior Iowa had prices higher than Chicago 77 percent of the time and an average price difference of 20 cents per 100 pounds. Chicago was higher only 23 percent of the time, with price averaging only 5.9 cents per 100 pounds higher. Thus, they state, (10, page 120)

> If the analysis of the actual and potential price differences between Chicago and Des Moines markets is correct, the Iowa farmers is paid handsomely on more than one occassion in the past five years (1933-1937) for the privilege of selling nearer home.

A more recent study by Stout and Feltner, Price Relationships in Market of Slaughter Hogs in Indiana, eliminates the shortcomings of most earlier studies. These earlier studies used market price quotations from U. S. Department of Agriculture Crop and Livestock Reporting Service. While these Crop and Livestock Reporting Service prices are representative for terminal market points, they are usually understated for interior Iowa marketing points. They are understated because these are not collected by Crop Reporting Service but are the result of receiving a telephone report

Table 2. Net hog price differences, Chicago over Des Moines; wholesale price at Chicago of 71.32 pounds of fresh and cured edible hog products; and the percentage of Iowa's hog marketing shipped direct, 1922-1937[a]

Month	Net difference (cents per 100 lb.)	Product prices	Percent directs
1933			
January	10.0	$ 5.33	56.1
February	10.5	5.49	55.2
March	10.0	6.21	57.5
April	2.0	6.25	59.0
May	4.0	6.73	55.2
June	1.0[b]	6.83	53.2
July	6.5	6.82	52.3
August	7.0	6.87	46.5
September	14.0	7.07	37.6
October	1.0	7.32	53.8
November	8.5	7.24	58.0
December	5.5	6.75	58.8
1934			
January	10.5	6.70	51.2
February	26.5	7.82	47.7
March	8.5	8.40	48.9
April	1.5	8.22	52.2
May	18.0	8.09	53.5
June	14.0	8.75	53.5
July	3.0	9.17	53.5
August	7.0	10.47	54.0
September	4.0[b]	11.69	52.4
October	3.5[b]	10.60	51.5
November	14.5[b]	9.99	52.5
December	21.0[b]	10.12	53.7
1935			
January	28.5[b]	11.74	59.9
February	15.0[b]	12.51	63.1
March	49.0[b]	13.31	63.8
April	22.0[b]	13.34	65.9
May	15.0[b]	13.81	65.5
June	14.5[b]	14.20	61.7
July	0.5	15.00	56.4
August	22.0[b]	16.57	59.4
September	22.0[b]	16.38	63.2
October	3.5	15.55	58.9
November	10.5[b]	14.84	67.1
December	13.5[b]	14.68	66.8

[a]Data taken from Duddy and Reizan (10).

[b]Des Moines over Chicago.

Table 2. (continued)

Month	Net difference (cents per 100 lb.)	Product prices	Percent directs
1936			
January	14.0[b]	$13.61	63.6
February	3.5	13.33	65.6
March	5.5	13.08	63.8
April	15.5[b]	13.26	67.2
May	15.5[b]	12.83	65.9
June	19.5[b]	13.20	68.8
July	2.5	13.61	61.4
August	16.5[b]	13.90	59.5
September	26.5[b]	13.88	63.6
October	20.5[b]	12.92	62.9
November	16.5[b]	12.36	61.5
December	23.0[b]	12.83	63.1
1937			
January	25.5[b]	13.08	61.8
February	20.0[b]	12.88	64.6
March	28.0[b]	12.79	65.8
April	40.5[b]	12.95	69.8
May	42.0[b]	13.58	69.7
June	28.5[b]	14.15	67.0
July	7.5	15.15	65.4
August	10.5[b]	15.90	62.4
September	10.0	15.77	64.4
October	12.5	14.27	67.1
November	8.0	12.59	66.6
December	5.5[b]	11.32	66.7

from these markets as to what is the typical price. These markets are under no obligation to report the accurate prices. But, Stout and Feltner avoided this error by collecting their own prices. They did this by putting an observer on the market to record the prices paid for slaughter hogs within four different weight groups. Three periods were studied, September 14-25, 1959; November 30-December 11, 1959; and February 15-26, 1960.

Correlation and regression analysis and measures of significant difference were used to analyze prices paid at the Indianapolis Stock Yards and the 25 largest surrounding daily hog markets in Indiana.

The conclusions drawn from this study were that terminal markets would not be regarded as the primary price basing point for hogs in the 200-220 and 220-240 pound weight; that the higher prices, at the terminal, for these weight hogs were not large enough to cover the added transportation costs; but, that the terminal markets did meet the criteria of price basing point for the 240-270 pound hogs. They also concluded that there was (1) no long-run price advantages to patrons of a particular market, and (2) that the small markets enjoyed no privilege of price domination beyond the small area in which these markets enjoyed a locational advantage.

A study by Maki and Strand (22), provides some additional knowledge about producers. Maki and Strand asked hog producers what major factors were used to choose a particular market outlet? The predominant factor listed by producers was the convenience of a market. The second factor listed was "best price" and third, the most competitive market. Producers also stated that they felt it took less skill to market hogs than it did to market cattle. Producers felt the specialized services offered at terminal markets were not

needed when marketing hogs. The closeness of a market to the farm is important to producers and Maki and Strand found that

> Except for sales through terminal markets, practically all slaughter hogs were sold through markets located within 50 miles of each producer. Moreover, the modal mileage group for the latter markets was 'under 10 miles,' or about a tenth of the average hauling distance of sales in the modal mileage group for the terminal markets.

A more recent study by Maki et al., discusses the economic structure of the meat industry (21). This study attempts to outline those forces which not only affect the consumption and production of our livestock, but how these factors affect the historical patterns of livestock marketing and meat distribution. The study was concluded by showing how locational patterns of production are related to the framework of interregional competition in the livestock meat economy.

The next group of studies can be categorized into one group. They are studies concerned with determining a better method of evaluating hogs when hogs are bought by the grade and yield method. The researchers in these studies have tested various factors which correlate highly with the higher yields of meat. A few of the major evaluating factors are average back thickness, length of carcass and weight of carcasses. An early study by Shepard et al., in 1940 pointed out that the carcass method of evaluating carcasses might be more accurate than many present methods of evaluating animals (38).

Engelman et al., in 1953 carried carcass research further, they compared the results obtained when estimating the yield of meat using the carcass method and by the live method (12). Engelman et al., also pointed out the advantages of each method of evaluating hogs.

Naive and Cox in 1957 tested the accuracy of other factors used when yields were estimated by the carcass basis (28).

Most of carcass studies indicate that the most accurate method of estimating yield from a carcass was to estimate the yield of the four primal cuts (hams, butts, loin, and picnics) and from this estimate, the total yield of meat. The most accurate factors for measuring ham, loins, butts, and picnics were the weight of the carcass and the average backfat thickness. Most of these carcass studies found that the length of the carcass does not add much accuracy to yield estimates.

THE MARKET BEHAVIOR OF HOG BUYING PLANTS

> The economic structure of the meat industry is characterized by the number and size of firms and establishments, the geographical location of these establishments, the rate of entry of new firms in the industry, the degree of vertical integration or specialization and the extent of product differentiation. The structural attributes are believed to account for the behavioral relationships of the firms are extremely difficult to ascertain; (21, pages 701-702)

This chapter, however, will attempt to point out some of the structural features of the livestock and meat industry to understand how firms might react under different conditions. The discussion in this chapter will be confined to packing firms operating in the area of monopsony or oligopsony and not in the traditional competitive framework. Nicholls said, "The fact that processor-distributors do not directly control the short run supply of the farm products, has therefore frequently been interpreted as precluding the existence of imperfect competition among them," (31, page 1).

The discussion will be limited primarily to the buying side of the hog packing business. The hog buying side is closely related to the selling side, but the selling effects will generally be ignored. The following influences will also be ignored, the effect of, economics of plant operation caused by the ridigities of labor employment, the ease of entry of firms, the effect of selling side locational advantage, the effects of differentiated finished products,

and the effect of any other factors which influence a firm's market conduct or performance. These factors will be assumed to remain constant throughout the analysis.

The purpose of this chapter is to determine what kind of structure or what kind of competition does exist on the buying side of hog packing plants or hog buying agencies. Also, to determine if this situation might explain why there could exist price differentials between various hog buying firms. Before examining the type of competition which might exist, in the hog packing industry, it might be helpful to delineate the number and type of hog buying firms in Iowa.

There are over 1,200 possible buyers of livestock in Iowa and most of these buyers would be purchasing both cattle and hogs (22). With over 1,200 hog buyers, how can the hog buying activity depart from the purely competitive model? There are, within the state of Iowa or near its borders, about 20 large pork packing plants located off the central public markets which will be referred to as interior packing plants (see Figure 1). There are also packing plants located adjacent to the following central public markets, Sioux City, Iowa; Omaha, Nebraska; Chicago, Illinois; St. Joseph, Missouri; Kansas City, Missouri; St. Paul, Minnesota; and St. Louis, Missouri. Combining the interior Iowa plants with central market plants there are over 50 major packer processing plants available to Iowa's producers. These

packer-processor plants are the major focal point for the pricing of hogs in Iowa. These packing plants are in integral part of the national market for finished or processed meat. The prices paid by these markets are influenced by the total supply of meat and the consumer demand as it is transferred through the consumer-retailer-wholesaler-processor-producer sectors.

The theory presented in this chapter is essentially the same as that used by Nicholls in his book, Imperfect Competition with Agricultural Industries (31).

The degree to which agricultural related industries operate in a quasi-monopsonistic framework, in respect to the purchasing of producers hogs, depends on their ability to differentiate their buying services. A major factor creating the differentiation of buying services is spatial location. Most of the spatial advantage, that one plant has over another, is primarily caused by lower transportation cost to producers marketing hogs. However, there may be other agricultural related services, located at a particular market point, that may contribute to the differentiation of a packing plant or market. A producer might use the opportunity to purchase other supplies when marketing his livestock, thus reducing actual marketing costs to a very low level. Before moving into a more precise discussion, it might be helpful to examine factors which might affect specific hog buying firms.

Interdependence not Recognized

The first discussion will be centered around firms that have many competitors and that no one firm recognizes his influence on the action of other buying firms, this would eliminate the effect of oligopsonistic interdependence. Oligopsonistic interdependence will be examined later.

Producer preferences for particular hog buying firms will affect the actions of those firms or markets. The markets preferred by particular producers selling their products will be referred to as service differentiated markets even though the producer preferences may not be due to definite services offered by the buying firm, but due to other factors which are peculiarly attached to that market by the livestock producer. Some of these services are convenient location of the buyer to the producer, reputation of the buyer, personality of the buyer or other attributes which may be attached to a particular buyer, the speed and efficiency which the hogs are handled and payments are made, and the "fairness" of grading and/or weighing. All these factors plus many others, real or fancied, contribute to the differentiation of buying services. They contribute to differentiation as long as the seller, livestock producer, feels that these attributes are a part of the market and they will continue to be effective as long as the seller uses these attributes to choose a particular hog market.

Buying under pure competition, the individual buyer's volume of purchases is completely dependent upon his competitors' prices, since the services one firm offers are identical to others. But, with producers preferences, a buyer has some independence of action, there is no longer one single large market, rather a network of interrelated markets. Under these conditions, a buyer's volume of purchase will depend on his conscious choice of services. The buyer's volume is also dependent on the buying costs incurred and the prices offered. The firm can no longer just buy on the basis of those prices thrust upon him by the competitive forces of market which are beyond his control. A buying firm operating in a pure competitive and free entry framework, if the firm is optimizing, will have a perfectly horizontal purchase curve. The purchase curve, of a differentiated buyer, will diverge from horizontal. A buyer operating in a preference framework has the choice of raising his buying price and buying more hogs or lowering it and buying less. Also, the firm's buying price will be dependent on how much his services differ from those of his competitors. A firm has some incentive to change the services he offers to appeal to new producers. A firm may influence his volume, of purchases, by making additional buying service outlays, such as solicitation by personal contact and advertising. The problem in this type of framework, facing the buying firm, is

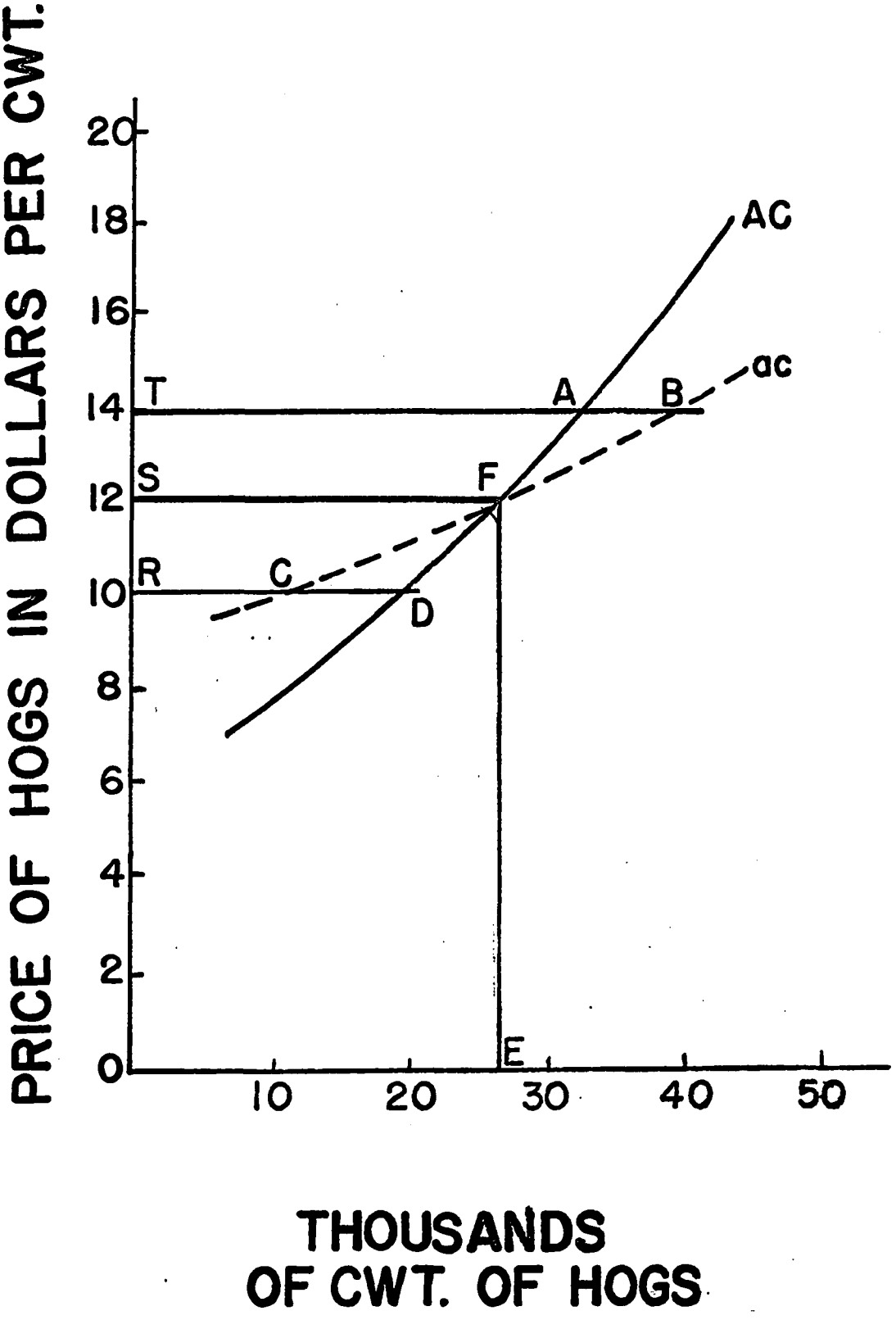
to determine the correct combination of prices, services and buying costs, which are all variable to some extent, that will maximize his returns.

Studies have been made that indicate producers do have preferences for particular markets. Maki et al., in his study "Iowa's Producers Choice of Markets," indicated that the primary reason producers chose a particular market, for their hogs, was the convenience of that market. "The most convenient market, however, was the dominant reason in the choice of a specified market outlet for hogs. . ." (22). The U. S. Department of Agriculture also made a study of producer hog market preferences the statement from that report reads:

> The market outlet which farmers said were the most convenient were local dealers, packing plants and concentration yards, in the order named. The greatest convenience as stated by many, was that hogs would be moved to such markets by truck. A substantial number selling to local dealers at concentration yards and at packing plants did so because they knew the price in advance. Less shrinkage was given by a substantial portion as the reason for selling at concentration yards, packing plants, auctions and local dealers. Other reasons given were that small lots sold more advantageously, that better service was obtained, and that control of sales...was possible... A considerable number preferred cooperative livestock shipping associations because they liked the cooperative principle. Of those favoring public markets, four percent gave their own opposition to direct marketing as a reason for this preference," (47, page 106).

Since producers preferences for markets do exist, how might these preferences affect the individual firm's purchasing curve? The AC curve in Figure 2 represents the

Figure 2. Average cost curve for hog buying firms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THOUSANDS
OF CWT. OF HOGS

quantities of hogs which will be offered to a firm, assuming that all rival buyers simultaneously change their prices as this firm or any firm changes its prices. The curve AC is a long-run aggregate supply curve for hogs. This curve indicates that, if hog production is to increase, resources will have to be pulled away from alternative uses. With pure competition, the firm's AC curve or purchasing curve would be perfectly horizontal. But, with some differentiation, the curve can depart from horizontal. The ac curve shows the volume of hogs available to a given buyer at different prices and services, when the prices and services of all other buyers remain unchanged.

The curve ac is more elastic than AC. This is true because a price increase by a single buyer will result in a larger increase in volume of purchases, if other buyers do not make the price change. When a single buyer raises his price from OS to OT, he will buy TB pounds of hogs, if his competitors do not raise their prices. But if the other buying firms do raise prices, the firm will buy only TA. Also, if the same firm lowers his price from OS to OR, his volume of purchases will drop to RC, but if his competitors follow the price change the volume will drop to only RD. The elasticity of ac is an index of producers preference for the services of one buyer over other buyers. The less preference shown the closer the ac curve will approach AC.

Differentiated Services

The analysis will change if additional assumptions are made. Let us assume that all services of each particular buyer are fixed but differentiated. In this case, there are still many buyers and that the effects of individual action will be diffused. Which means, that gains made from a price change by one firm will not be equally shared by all other buyers. A firm operating in this type of market will not have to consider the action of his competitors. He can, without fear of retaliatory action, induced by his own actions, pursue an aggressive price policy.

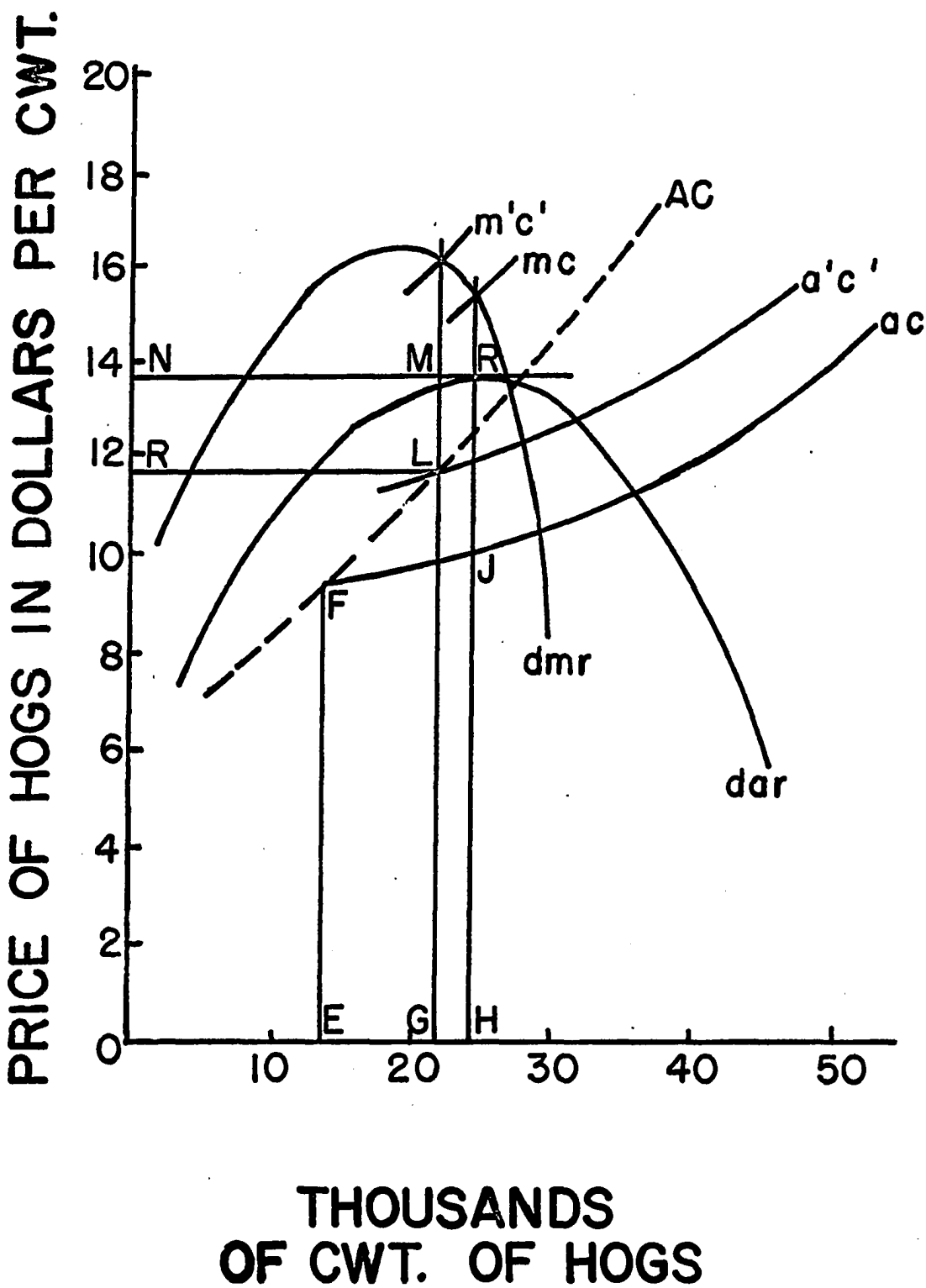
Two other primary curves will be added to those curves on Figure 2 to develop Figure 3. They are dar and dmr as developed by Nicholls (31).

dar = The price a producer can pay for inputs (hogs in this case) which is obtained by subtracting processing and distribution costs from gross revenue of the firm.

dmr = Is the curve of the addition to total net revenue.

Superimposing the above curves plus the marginal cost curve mc, for the firm which is represented by ac, Figure 3 is obtained. With a purchase curve located at ac, the intersection of mc curve with dmr indicates the price paid by this firm for hogs will be OK and volume purchased will be

Figure 3. The price and prodúrement level of hogs by hog buying firms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OF CWT. OF HOGS

OH. The excess profits in this case would be JR x OH. If ac was representative of every firm in the industry, a different price pattern would result. This condition would exist if each producer had evenly distributed preferences, so that each buying firm had no advantage over his competitors, then, AC would represent the price of hogs to every buyer, not ac.

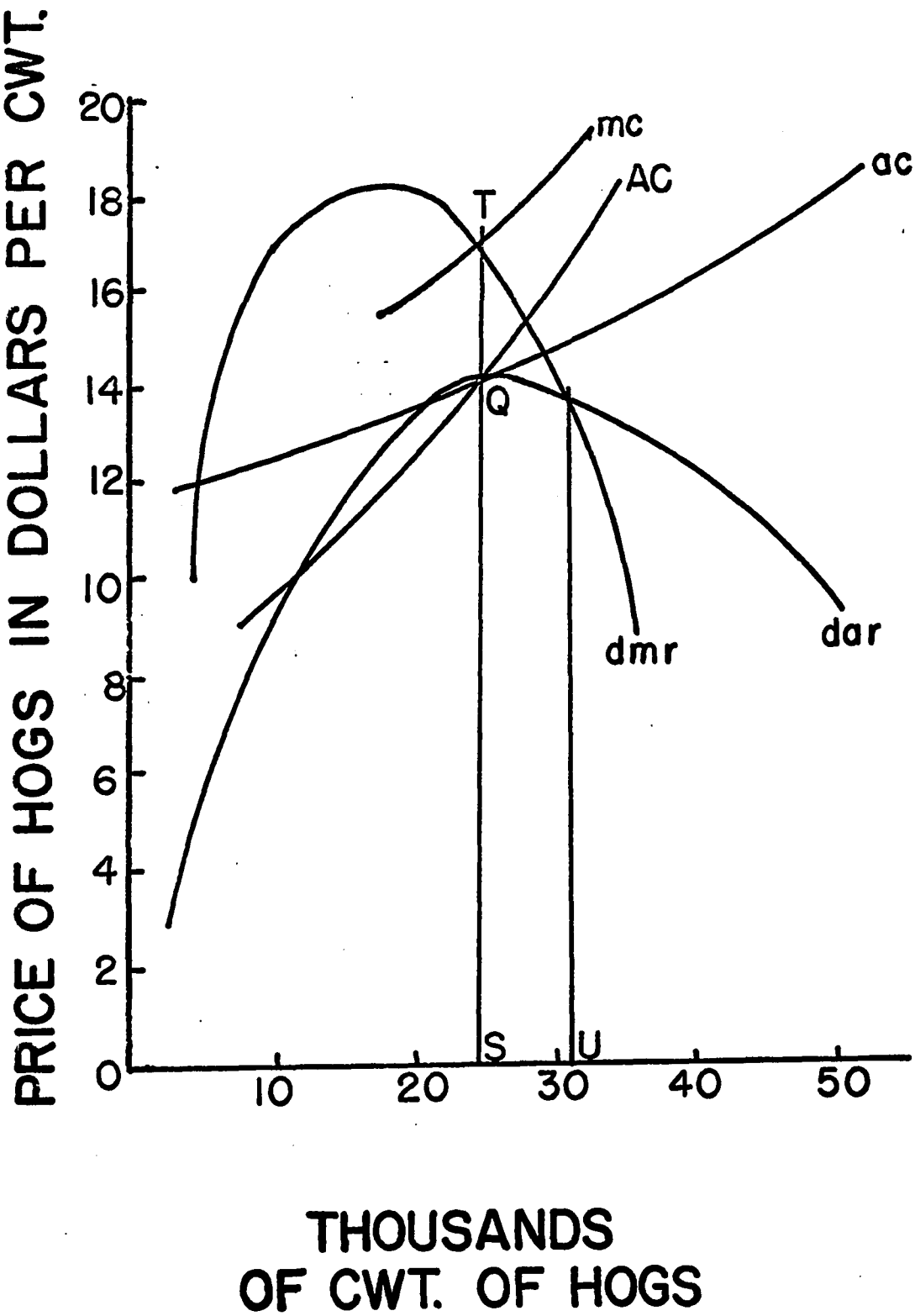
Continuing the analysis, if EF is the original buying price, any movement of prices upward toward HJ will expand purchases to OH. Each firm would move prices in the same direction. As these price increases take place, the gain will prove illusory, because the gain in business would be shown by AC not ac. Yet, the ac curve explains why each buyer will feel he can bid up his prices. The movement upward will continue until the price of KL and volume OG is reached. The upward price movement will stop at KL because, at this point, ac meets with AC and marginal costs (mc) equals derived marginal revenue (dmr).

At this point excess profits KLMN are obtained. However, this position would not be stable because new firms would be able to enter the industry. Even though the new firms could not exactly duplicate the older firm's services, they could conceivably approximate them close enough to enter the industry and gain a portion of the hog supply. New firms entering the industry would force the AC curve to move

to the left. The leftward movement would continue until the ac curve was tangent to the derived average revenue curve (dar). Figure 4 illustrates this position. The price SQ is lower than it was when there was no differentiation of services. Also the quantity purchased OS is less than OU. The volume under pure competition is represented by OU, whereas, OS represents the volume when there are differentiated services.

The existence of the situation first described in Figure 3 could well have been the position of (independent) interior Iowa packers before the major packers moved away from the terminal markets. The independent packers located within interior Iowa had certain locational and services factors that must have attracted producers so these interior plants could obtain hogs even with lower buying prices. But the movement of more packing plants into the interior caused profits to be squeezed. Whether the present packing industry has reached the point shown in Figure 4, that Chamberlin describes as "sort of ideal" is not known (5). It would appear that with the present interest in establishing new plants in Iowa, that the "sort of ideal" has not been reached. However, it is possible, in a dynamic framework of imperfect knowledge, for firms to speculate that there are excess profits in an industry when, in fact, none exists. Upon entering the industry, the new firms find that no excess profit exists.

Figure 4. The effect of competition on monopsonistic hog buying firms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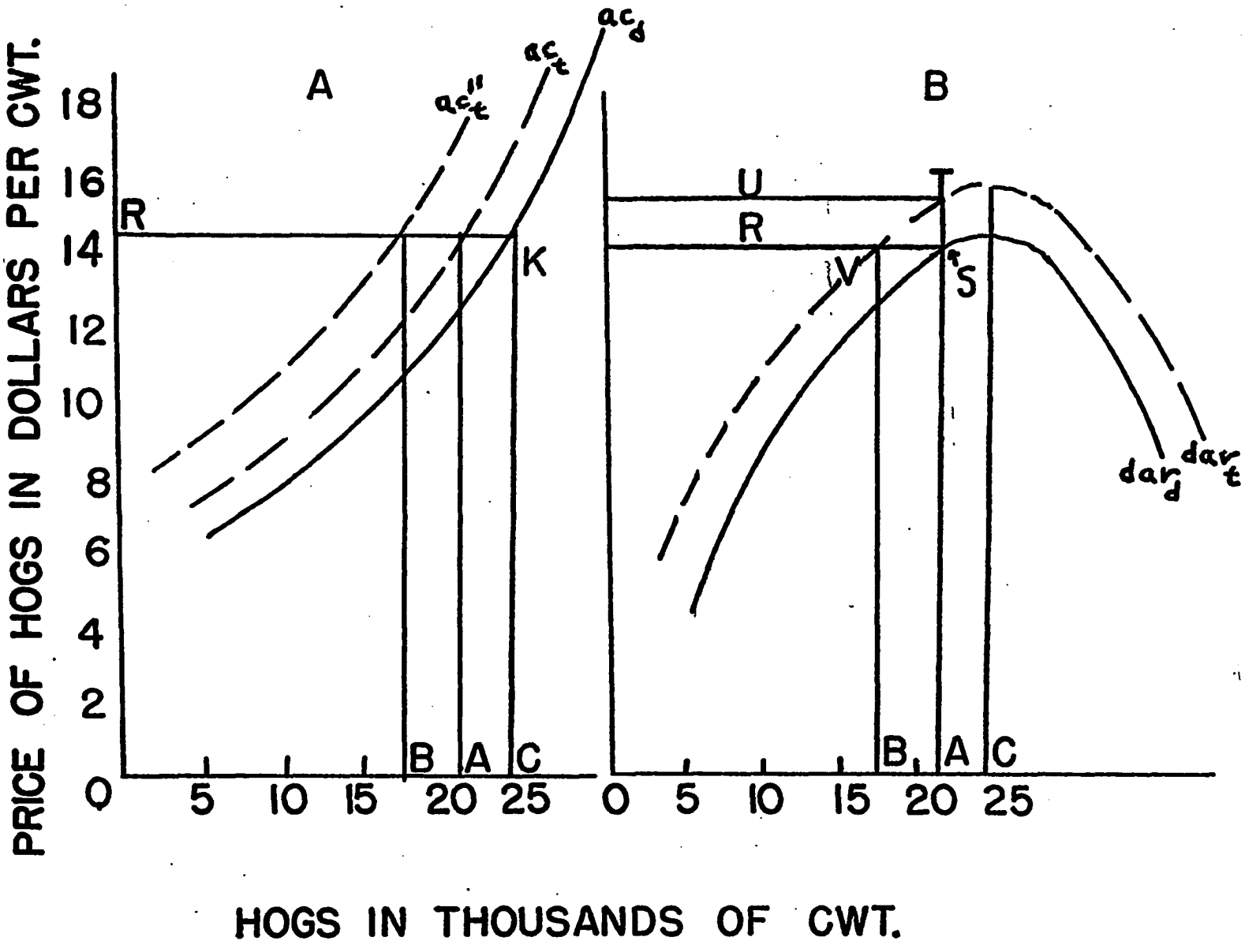
THOUSANDS
OF CWT. OF HOGS

Imperfect knowledge of profits is one of the factors that contributes to over capacity in an industry.

Terminal Market Buying and Direct Buying

To expand or clarify the analysis of buying firms reaction further, two specific types of competitive services will be analyzed. One type of service is offered by terminal markets; another type is offered by packers buying hogs direct. Before proceeding with the analysis, one assumption will be made -- that prices will be fixed, but not services. All packers, in this example, will be initially buying their hogs from the terminal yards as was true for most packers 50 years ago. The purchase curve of the packer buying on the terminal yard will be ac_t as shown in Figure 5A, curve ac_t represents direct buying. When the packer buys at the terminal market, his derived average revenue is dar_t as shown in Figure 5B. The assumption, as stated above, indicates that prices will be fixed at OR or OK, Figure 5B. The amount of hogs a packer can buy through terminals is OA as indicated by curve ac_t, Figure 5A. A packer buying hogs at price OR and volume OA can made excess profit TSUR. The excess profits exist because the dar_t curve of Figure 5B indicates firms could actually pay OU prices rather than OR prices. The entry of new firms into the market will cause profits to fall because the volume of each plant will be reduced toward OB (Figure 5B). The reduction in volume purchased by each

Figure 5. Terminal market buying and direct buying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HOGS IN THOUSANDS OF CWT.

firm will cause ac_t to shift toward ac''_t, at which point excess profits disappear, as shown by point V on Figure 5B.

But, a packer might avoid the decline in volume by improving services offered to producers. He might do this by setting up country buying points, which all were convenient to producers marketing hogs. These new sercices may be a more expensive method of buying hogs than buying at the terminal yards, but if enough producers are attracted to these newer services, a packer may expect to increase his profits. If the services offered by his competition remain unchanged, the additional volume, at set prices, might assure him some excess profits. The change or improvement in services will shift his supply curve along RK from ac_t to ac_d (Figure 5A). Because of the shifting of costs, the derived average revenue dar_t will decline toward dar_d (Figure 5B). How far it will decline largely depends on the increased operating costs. If only one firm would make the shift to greater services, excess profits could be realized. The equilibrium would be reached only when dar finally reached the level of dar_d as shown in Figure 5B. This would probably be the point where packers offered the correct combination of services, direct buying and terminal buying, that satisfied all producers. The equilibrium point would be reached only when no more additional services could be offered by any firm and no firm was making excess profits. In

a dynamic framework this point is probably never reached, as new innovations are continually introducing new factors into the market. Also, inadequate or inaccurate knowledge prevents firms from discerning how to satisfy all producer wants at any given time.

The previous analysis assumed that prices were fixed but if both prices and services were allowed to vary full equilibrium would not be achieved until each buyer felt that further changes, in either prices or services, would not improve his profit position.

Chamberlin stated, (5, page 99)

> As soon as we recognize that the buying price is variable, however, the fact that the price paid by a buyer offering given services must be lower under monopsonistic than pure competition insures that the services will be somewhat inferior. This is true simply because, if a buyer could, by a larger scale of operations which is characteristic of pure competition as compared with monopsonistic competition, give the same services for less money, he could, similarly, give better services for the same money.

Oligopsonistic Interdependence

While the previous discussion has some validity, because it helps to expose a few basic points, most packing firms do realize their actions will have an influence on other packing firms. Whether they generalize this knowledge and apply it to all packing firms or only those packing firms adjacent to them is immaterial in the final analysis.

The recognition of interdependence was portrayed by a buyer for a western Iowa packing plant. This western Iowa packing plant usually obtains most of its hogs from nearby producers, but occasionally they find themselves short of hogs, not enough hogs to finish out a particular day's kill. In order to fill out their kill, the packing plant buys hogs at the terminal yards. In the light of this situations, a packer buyer of this plant was asked, why the plant filled out their kill with terminal market bought hogs; why didn't they just raise country prices 25 to 50 cents per hundred pounds? With a price raise of this magnitude, the packing plant could obtain sufficient supplies without going to the terminal markets and the locally purchased hogs would not cost any more, because the packer would save transportation costs. The buyer's answer to this was, "If we raised the local price of hogs, to fill our kill, we would cause other interior packers to raise their buying price, thereafter, our hogs would cost more." This statement may not be rational, but as long as the buyer felt it was true, it will affect his buying policy. Interdependence was recognized by this buyer.

The recognition or existance of price interdependence does not imply that packers feel there is service interdependence. Most packing firms do not have the identical services, some firm's services are preferred over others. However, interdependence does mean that a given change in services offered by one firm will affect other firms which

provide similar services. This is true, even if these services are a result of spatial location.

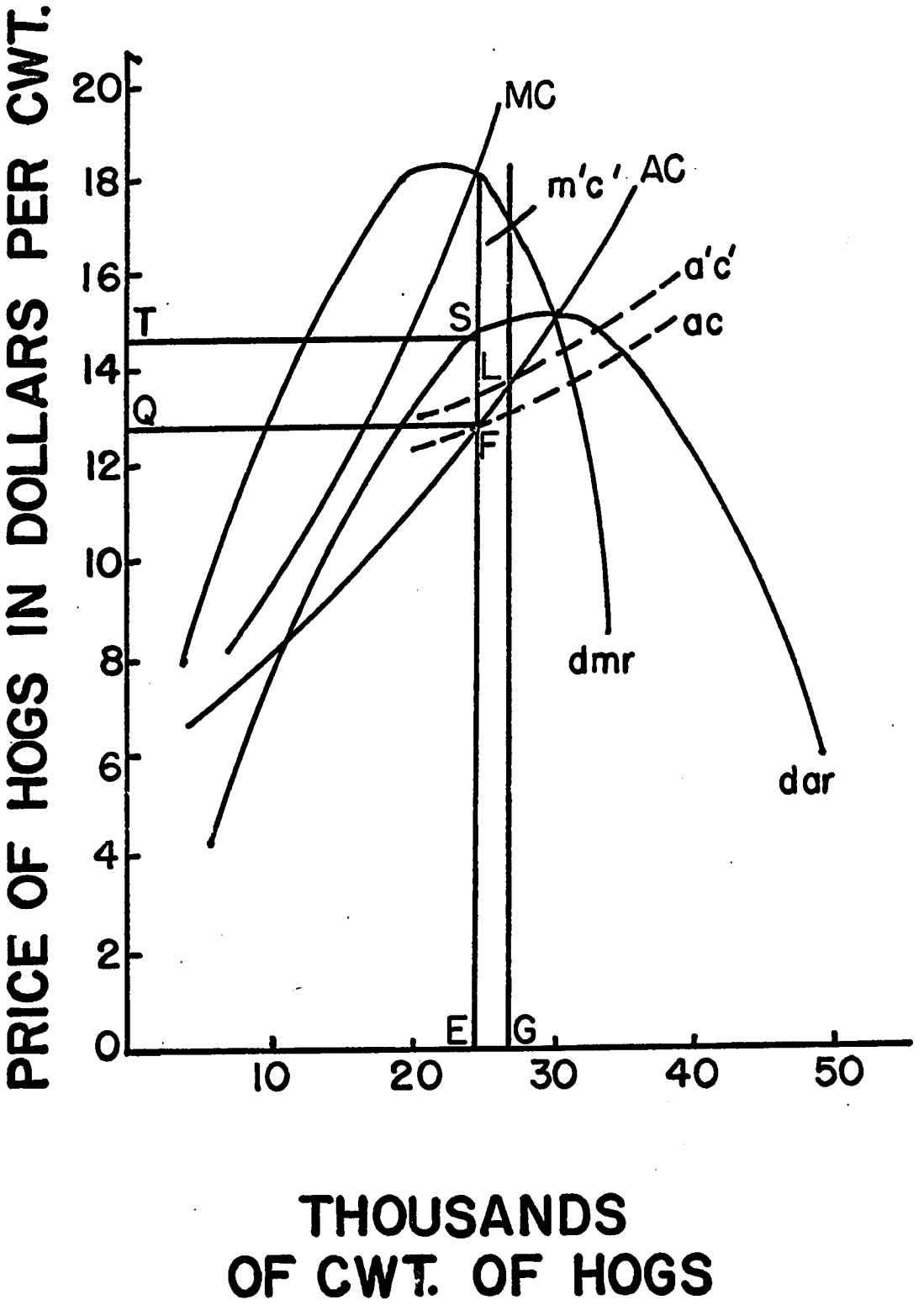
If the economic structure of an industry is such that individual firms are aware that any actions taken by them will be followed by their competitors, this is called oligopsony. How would the prices for hogs be determined under an oligopsony situation?

The reactions of the competitors is the important factor in an oligopsony framework. Figure 6 includes the curves dar and dmr, AC, ac, and a'c' found in Figure 3. In the earlier case, when oligopsonistic influence was small, the price was EF. Originally, the price was bid up to GL when the number of firms was limited. Also in the earlier example, AC was not based on reactions of competitors, rather it simply indicated the actual movement of prices as the firms acted independently. The analysis was based on the fact that each firm throught the other firms would not follow their price movement, but the fact that they did caused price expectations to move along AC.

But, if competition is largely confined to only a few close competitors, AC slope will depend upon the reaction of these competitors to a change in price or service policy.

If the firms in the industry, develop a non-aggressive pricing policy, firms would do this because they had learned that aggressive action was followed by their competitors, the pertinent buying curve would be AC in Figure 6 not ac.

Figure 6. The reaction of competitors to appressive and nonaggressive buying policies


PRICE OF HOGS IN DOLLARS PER CWT.
20
18
16
14
12
10
8
6
4
2
0
MC
m'c'
AC
a'c'
ac
T
S
L
Q
F
dmr
dar
E
G
10
20
30
40
50
THOUSANDS
OF CWT. OF HOGS

The price would EF for a given number of firms, that is, no entry. If firms do not estimate competitors reactions, ac is the more appropriate pricing curve. If, however, an individual firm feels his services are different and others cannot duplicate them, the firm will expect to operate on curve ac, but will actually move along AC. The greater the number of buyers, the closer the price will be to GL. The reason stability could be attained at some point between EF and GL, with an aggressive policy, is that at some point marginal costs equal derived average revenue (i.e., m'c' = dmr).

If prices remained at EF, it would mean that firms had, by their actions, decided market sharing was the best long run policy. Although as this analysis shows, it would not be necessary to have agreement between the various packing firms.

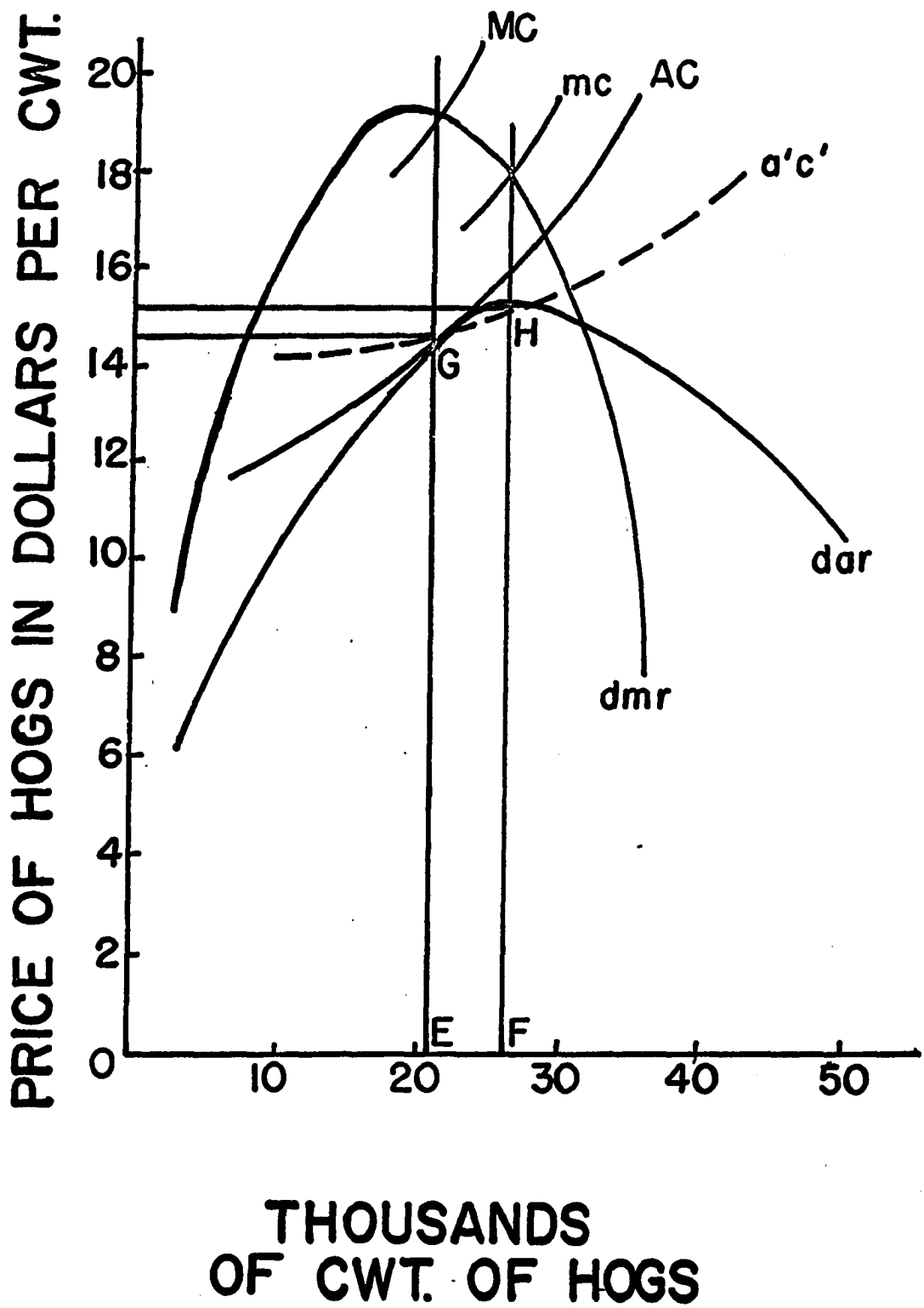
Free Entry of Firms

Since the earlier discussions, in most cases, were limited to a given number of firms, excess profits could be maintained. But, this is an unrealistic assumption in a dynamic market. Therefore, the analysis will be extended to show a final equilibrium position when there is relatively free entry of firms. There are two positions which can be contemplated from the previous analysis, one where the firms follow an aggressive policy, that is, they do not recognize interdependence and two, where interdependence is recognized

and that the action of a competitor can be estimated exactly, so that a non-aggressive pricing policy or oligopsony is followed. Figure 7 shows these positions and prices.

Price EG is the price for hogs under the non-aggressive price policy. Here firms recognize that AC is the appropriate response curve. When AC is tangent to derived average revenue curve (dar) an equilibrium position is reached. There exists no excess profits at this position. With an aggressive policy, the firm will operate as if ac was the buying curve, at F, ac is tangent to dar, EF is the hog price and there is no excess profits. It can be noted that the price is higher and volume is larger than they are under the non-aggressive price policy. Both the price and the volume are lower in the preceding case, than they would be if the firms were operating competitively with no differentiation of buying services. The average cost curve, in a purely competitive framework, would be parallel to the base and tangent to the derived average revenue curve at a higher point than FH. The case represented by volume OF and prices FH is the "sort of ideal" mentioned by Chamberlain discussed earlier. This price is higher than an oligopsony price, but lower than a purely competitive price. Exactly where the present packing firms or industry are operating is not known, but there are conditions, within the industry, which would make the industry depart from the purely competitive model.

Figure 7. Long run equilibrium position of hog buying firms


PRICE OF HOGS IN DOLLARS PER CWT.
20
18
16
14
12
10
8
6
4
2
0
MC
mc
AC
a'c'
dar
dmr
G
H
E
F
10
20
30
40
50
THOUSANDS
OF CWT. OF HOGS

Being that it is difficult for firms to anticipate how far or fast a competitor can duplicate prices and services would seem to indicate the industry is operating in a manner which would place them somewhat between price EG and price FH.

How much lower present how prices are, than they would be if the packing firms were buying in a pure competitive framework, is not known, but they are obviously lower.

Selling Side Effects

The preceding discussion has been limited to the buying side of packing companies but in actual practice, the buying side is an integral part of the total plant operation. Actions taken on the selling side will affect the buying side and vice versa. The assumption made in this analysis was that there are identical selling prices. This is an over simplification of the real world. Each packing plant has different prices for some of their finished pork products. There is more differentiation of pork products than there is for beef. Government grading of beef has eliminated most of differentiation attempted by large national packing firms. But, pork has no Federal consumer grades. Each packing company develops and promotes its own brands on cured pork products, i.e., hams, picnics, bacon, and prepared meats. Packers have not been very successful in differentiating fresh pork cuts, but this has and is being tried. National packers

have an advantage over small packing companies in that they have wider distribution of their products and can advertise nationally.

Therefore, if a packer can differentiate its products in the eyes of consumers, it will be able to raise prices on those products preferred by consumers. The higher price charged for successfully differentiated products may make it possible for these packers to pay more for hogs than those without preferred products. If packers can do this, part of the preceding analysis will be incorrect. However, if the cost of differentiation, advertising, promotion, etc. results in higher operating costs, then the effect may be only negligible.

The primary purpose of the preceding analysis was to discuss why there might exist price differences between hog markets. The purpose was also to discuss the rationals which might cause some packing plants, buying hogs, to pay higher prices than other packing plants do. The preceding analysis might also help explain why there might be excess capacity in the industry. That is, packing plant capacity larger than one might expect from a purely competitive industry.

The explanation of packing firm action is greatly simplified and many of the assumptions were extremely limited and unrealistic. Yet, the discussion does explain some of the market behavior of individual packing firms.

A great deal needs to be learned about packing firms buying policies if one is to understand the effects on producers. The continual establishment of new packing firms in the industry further complicates producer selling decisions. However, it is possible that the greater concentration of packing firms, within a given production area, may eliminate price differences created by spatial location and other specialized services. However, this could cause packing firms to more readily recognize interdependence and thereby forcing the industry to operate more like an oligopsony than it does now.

PROCEDURE

This study was designed to measure the hog price differential between different markets and methods of marketing. The hogs for this study were procured, by Iowa State University, from the Bisland Memorial farm at Madrid, Iowa. The hogs, a by-product of irradiation research on their sires, were purchased after they were no longer needed for research by the University. The normal policy is to keep the marketable hogs on the farm only 154 days after farrowing, then they are marketed. The hogs used in this study were dept, separate by litters, for 154 days. After 154 days, the hogs were removed from their litter pens, weighed, and transferred into holding pens. The hogs were divided into eight weight groups. Equal numbers of each weight group were put into four separate pens or lots. No attempt was made to separate the hogs by grade, it was believed that, if the selection was made only by weight, the grade of hogs would be randomly distributed between pens. If there were any tendency for certain weight groups to grade higher, then each lot would have equal chance to receive them.

All hogs, for a given shipment, did not come out of litter pens on identical days. The farrowings were staggered, some days insufficient hogs were available to make up four full lots or pens. The procedure followed in this case was to retain the hogs in the holding pens until enough hogs were

were assembled to make four normal truck loads. The hogs of four shipments or one block of shipments were marketed on identical days.

Six markets were selected to represent the three primary methods of marketing hogs in Iowa. The markets selected and a brief discription of their activities are as follows:

Sioux City Terminal Market -- hogs sold live, generally mixed but some sort at times -- Sioux City, Iowa.

Omaha Terminal Yards -- sold the same method as Sioux City -- Omaha, Nebraska.

Waterloo, Iowa -- hogs sold carcass grade and yield.

Des Moines, Iowa -- carcass grade and yield.

Fort Dodge, Iowa -- hogs sold live sort.[1]

Cedar Rapids, Iowa -- hogs sold live sort.[1]

Since there were six markets and only four lots (there were only four lots available on the farm and the AEC did not want these salvage hogs to interfere with their other research operations) an incomplete randomized block design was used to select markets.

The markets were selected by an incomplete randomized block design and the lots were selected by using Snedecor's randomized table of random numbers (40).

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[1]Instructions to buyer were to sort them in a way they could bring the highest possible price.

The information for each block of shipments was sealed in envelopes until the day of shipment, at which time the farm manager opened the envelope to determine market each lot was to be shipped.

The following block design outlined by Cochran and Cox (6, pages 471-472) was used:

First Marketing Period

Date shipped	Block	Market	Market Designation	
August 26, 1963	1	1-2-3-4	Cedar Rapids	1
August 29, 1963	2	1-4-5-6	Fort Dodge	2
September 3, 1963	3	2-3-5-6	Sioux City	3
September 4, 1963	4	1-2-3-5	Omaha	4
September 9, 1963	5	1-2-4-6	Des Moines	5
September 10, 1963	6	4-5	Waterloo	6

The pattern for the second marketing period was different from the first in that for each block, three different methods of marketing were in each block. During the first marketing period it was possible to have only two methods of marketing in each block. Also, the greatest differences found in the first marketing period were between carcass grade and yield method and terminal markets so the next experiment was designed to assure the greatest number of comparisons possible between these methods.

Second Marketing Period

Date Shipped	Block	Market
February 27, 1964	1	1-2-4-5
March 2, 1964	2	1-3-5-6
March 5, 1964	3	3-4-5-6
March 9, 1964	4	2-4-5-6
March 12, 1964	5	1-2-3-6
March 18, 1964	6	1-3-4-5

There were a total of 1,083 hogs shipped during the first marketing period with an average initial weight of 204.4 pounds per head. A total of 1,032 hogs during the second period with an average weight of 197.5 pounds per head, see Table 3.

A check was devised to determine if lots within a given block were similar, although the analysis does not rest on the validity of this check. The check was obtained by computing a composite value for each lot or shipment. The composite value was obtained by obtaining the meanprice of six interior Iowa markets, by weight group, from the Des Moines Register on each day a shipment was made. The six interior markets were Des Moines, Fort Dodge, Mason City, Waterloo, Ottumwa No. 2, and Storm Lake. The price quotations were separated into the following weight groups: 170-180 lbs., 180-190 lbs., 190-200 lbs., 200-220 lbs., 220-230 lbs., 230-240 lbs., 240-250 lbs., and 250-260 lbs. The individual

Table 3. The distribution of hog weights sold during the two marketing periods

Block	Weight groups - pounds 170-179	180-189	190-199	200-229	230-239	240-249	250-259	260-269	270-279
	No. head								
Fall Market Period									
1st	4	37	15	93	14	2	2		
2nd	13	43	38	94	9	1	1		
3rd	8	31	42	90	12	6	1		
4th	8	32	37	100	9	4	1	1	
5th	10	38	45	100	16	8	2	1	
6th	16	16	31	48	12	4	1		
Total	59	197	208	525	72	25	8	2	
% in wt. group	3.97	17.82	19.57	48.66	6.65	2.40	0.65	0.28	
Spring Market Period									
1st	28	53	37	58	5				
2nd	20	43	39	50	3	2	1	1	1
3rd	25	38	63	75	6	6	2	1	
4th	22	33	48	46	3	4			
5th	14	37	36	57	8	7	1		
6th	22	48	38	44	5	2			
Total	131	252	261	330	30	21	4	2	1
% in wt. group	12.69	24.42	25.29	31.97	2.91	2.03	0.39	0.19	0.10

mean price of each weight group was multiplied times the weight of each hog falling into that weight group. Since the quotations contained overlap in the weight breakdown in the quotations, (i.e., 170-180, 180-190, there are two weight groups the 180 lb. hog could go into), a hog that weighted 180 pounds was moved into the higher weight group and the same procedure was followed for all other duplications. A composite value of the shipment or lot was obtained by all of the individual hog values. The total composite value of a shipment was divided by the total weight of the shipment to obtain the composite price of that shipment. A comparison of the composite prices, for each lot within a block, would give some measure of the consistency of the sort. If large differences between lots, within a block, had been found, it would have eliminated any need for further analysis. Because, most of the differences would have been due to sort and the differences between markets could not have been detected.

Two basic prices were used to analyze the data obtained in this study. These prices were computed for each shipment of hogs to a market.

One of these was called market weight price. Market weight price was computed by dividing the total value of a shipment (minus any marketing charges assessed by a market) by the weight of the hogs as they reached the market.

$$\text{Market weight price} = \frac{\text{(value of shipment)-(marketing charge)}}{\text{(market weight of hogs)}}$$

The other price was original weight price. Original weight price was computed by dividing the total value of a shipment (minus any marketing charges) by the original weight (weight of the hogs as they came out of litter pens) of the hogs.

$$\text{Original weight price} = \frac{\text{(value of shipment)-(marketing charge)}}{\text{original weight of hogs}}$$

The only marketing charges deducted for the interior sold hogs were the deduction for the American Meat Board. The marketing charges deducted from terminal sold hogs were commission, yardage fee, cost of feed fed to hogs on the market prior to sale, fire insurance, inspection fee and American Meat Board deductions.

The truckers hauling the hogs were unaware this study was being conducted. If the markets, involved in the study, were aware that the data from the hogs sales were being analyzed for market price differences, they could seriously bias the data. Therefore, truckers were informed, if they raised any questions about the numerous ways hogs were being marketed, that this was normal government policy. Most of the truckers were aware that the AEC was operated partly by the United States government and that previous shipments were sent to many different markets.

ANALYSIS OF DATA

Analysis of variance and multiple regressions were used to analyze the data from this study. The regressions were designed to measure hog price differences between markets and/or different methods of marketing. The methods of marketing selected in this study were represented by (1) two terminal markets (Sioux City and Omaha), (2) two interior Iowa packing plants using carcass grade and yield buying methods (Des Moines and Waterloo) and (3) two interior Iowa packing plants buying hogs on a live sort basis (Fort Dodge and Cedar Rapids).[1]

The data for this study were collected during two marketing periods. The first period was during August and September, 1963. The first marketing period had 22 shipments of hogs. The 22 shipments were divided into five blocks of four shipments and one block of two shipments. The second marketing period took place during February and March, 1964. This marketing period contained 24 shipments divided into six blocks of four shipments.

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[1]The terminal markets will be referred to as A markets (Sioux City = A_1; Omaha = A_2), the two carcass grade and yield buying plants as B markets (Waterloo = B_3; Des Moines = B_6, and the two live sort buying plants as C markets (Fort Dodge = C_4; Cedar Rapids = C_5). The four interior Iowa packing plants selected do buy hogs by other methods than those utilized.

Hypothesis

The hypotheses tested were (1) there are no price differences between hogs sold at the terminal markets and those sold at carcass grade and yield buying plants, (2) there are no price differences between hogs sold at terminal markets, carcass grade and yield buying markets and those sold to markets using live sort buying methods, (3) there are no price differences between hogs sold at the two terminal markets, (4) there are no price differences between hogs sold at the two carcass grade and yield buying markets, and (5) there are no price differences between hogs sold at the two live sort buying markets. Also, since there was a change in the general hog price level between the two marketing periods, a price responsiveness was determined for each market. Figure 8 illustrates the changing price level found in this study.

Hogs within a block or between shipments within a given block were assumed to be of the same quality, but not between blocks. Therefore, dummy variables had to be for each block of shipments to allow for hog price changes between blocks.

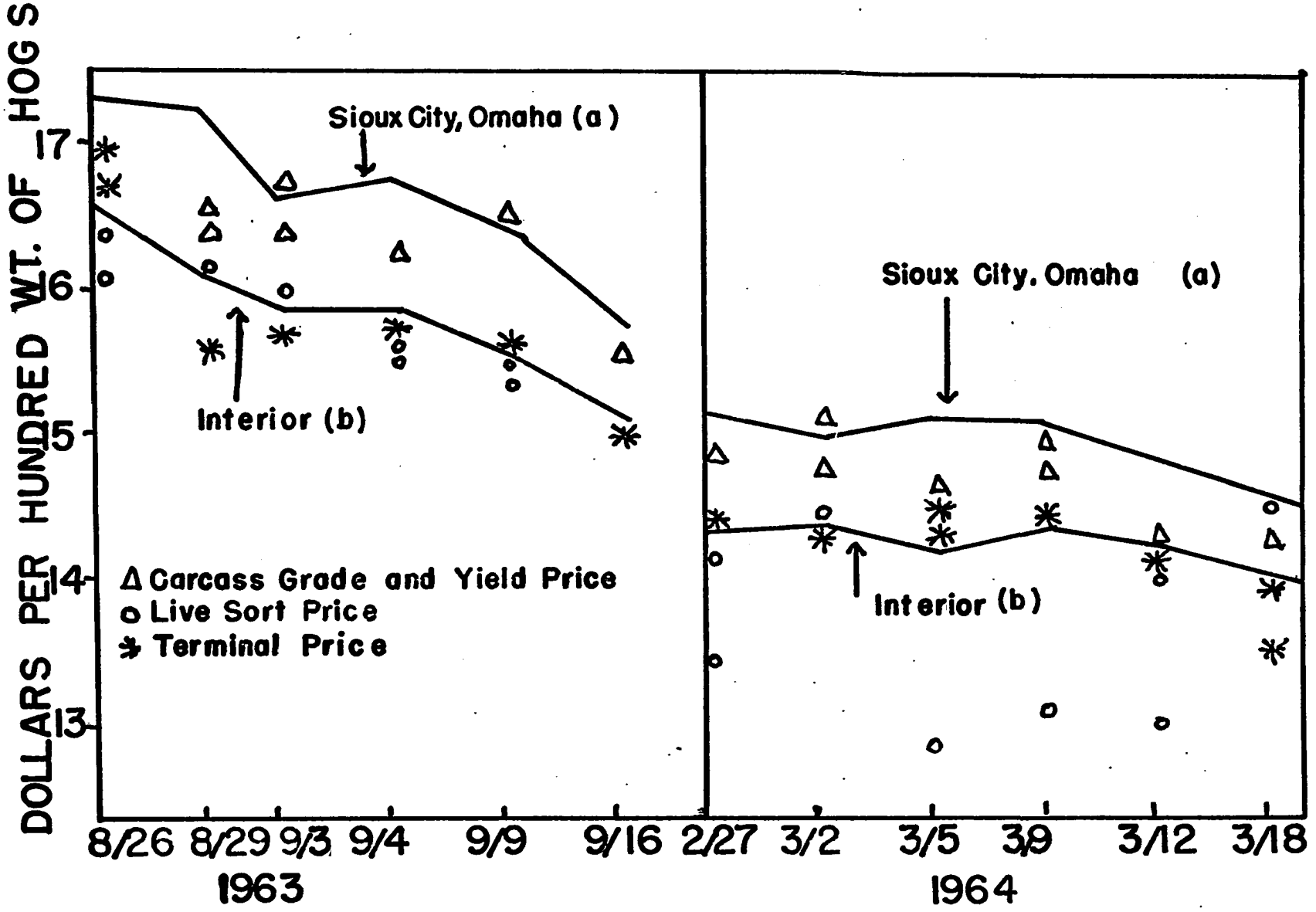
Summary of the Analysis of the First Marketing Period

The data were first analyzed in two separate parts. The analysis of the data from the first marketing period (using market weight price) is summarized below. (Page 143 and Tables 17, 18, 19, and 20 in Appendix A contain the ANOV, R^2,

Figure 8. Actual prices received compared with quoted prices

(a) Average price of No. 1-3, 200-220 pound butchers at Sioux City and Omaha, No. 1-3, 220-220 pound butchers.

(b) Average interior Iowa and Southern Minnesota, No. 1-3, 200-220 pound butchers.


DOLLARS PER HUNDRED WT. OF HOGS
17
16
15
14
13
Sioux City, Omaha (a)
Interior (b)
Δ Carcass Grade and Yield Price
o Live Sort Price
* Terminal Price
Sioux City, Omaha (a)
Interior (b)
8/26
8/29
9/3
9/4
9/9
9/16
2/27
3/2
3/5
3/9
3/12
3/18
1963
1964

standard errors and other pertinent data for the first marketing period, page 143 and Tables 21, 22, 23, and 24 for the second marketing period.)

1) A price difference of 71 cents per hundred weight was found between the A and the C markets. This value was significant at the .01 level.
2) A price difference of 50 cents per hundred weight was found between C and B markets, in favor of B market. The data were significant at the .01 level.
3) A price difference of $1.21 per hundred weight was found between B and C markets, in favor of B market.
4) No significant price difference was found between the two A markets, or between the two B markets or between the two C markets.

Summary of the Analysis of the Second Marketing Period

1) No significant price difference was found between the A and C markets.
2) A price difference of 36 cents per hundred weight was found between the B and C markets in favor of the B market. This was significant at .05 level, with time trend significant at the .01 level.

3) No significant price difference was found between the two A markets.

4) No significant price difference was found between the two B markets.

5) A price difference of 62 cents per hundred weight was found between C_4 and C_5 markets, in favor of the C_5 market. This datum was signigicant at the .01 level.

Analysis of Combined Marketing Periods

These results indicate that there were significant hog price differences between markets. And the greatest hog price differences were between the carcass grade and yield markets and the terminal markets. The results obtained from the marketing periods analyzed independently were not identical or consistent, therefore, the data were combined into a common analysis. The earlier analysis indicated that the greatest hog price differences were between terminal markets and carcass grade and yield markets. The analysis of the combined data was set up to specifically measure the difference between these two types of markets.

The general multiple regression equation used to analyze the combined data is as follows:

X_1 or X_2 is function of X_{16} through X_{18}, X_{25}, X_{35}, X_{36}, X_{37} or more specifically, selecting one dependent variable.

$$X = a + b_6(X_6) + b_7(X_7) + b_8(X_8) + b_9(X_9) + b_{10}(X_{10})$$
$$+ b_{11}(X_{11}) + b_{12}(X_{12}) + b_{13}(X_{13}) + b_{14}(X_{14})$$
$$+ b_{15}(X_{15}) + b_{16}(X_{16}) + b_{17}(X_{17}) + b_{18}(X_{18}) \quad |1|$$
$$+ b_{19}(X_{19}) + b_{20}(X_{20}) + b_{24}(X_{24}) + b_{25}(X_{25})$$
$$+ b_{35}(X_{35}) + b_{36}(X_{36}) + b_{37}(X_{37}).$$

Dependent variables

X_1 = Market weight price per pound of hogs received at the market, less marketing cost (not including transportation costs) divided by the weight of the hogs at the market.

X_2 = Original weight price per pound of hogs received at the market, less marketing costs (not including transportation cost), divided by the weight of the hogs at the AEC farm before shipment.

Independent variables

The definition of independent variables is as follows:

X_6 through X_{16} = dummy variable used to account for the twelve blocks in which hogs were shipped on separate days. This variable was used to account for any price difference between blocks. The subscripts refer respectively to X_6 = first shipment or block, X_7 = second

shipment or block, ..., X_{16} = last shipment or block.[1]

X_{17} = variable used to determine the price difference between carcass grade and yield markets and terminal markets that is B (carcass grade and yield markets) = 1 and C (terminal markets) = -1.

X_{18} = a variable for measuring the price difference between carcass grade and yield markets (B), terminal markets (A), and the live markets (C). That is, A (terminal markets) = 1, B (carcass grade and yield markets) = 1, C (live markets) = -2.

X_{19} = a variable measuring the price difference between the two terminal markets. That is, A_1 (Sioux City) = 1 and A_2 (Omaha) = -1.

X_{20} = a variable measuring the price difference between the two carcass grade and yield markets. That is, B_3 (Waterloo) = 1, and B_6 (Des Moines) = -1.

X_{25} = a variable for measuring the price difference between the two live interior markets. That is, C_4 (Fort Dodge) = 1, and C_5 (Cedar Rapids) = -1.

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[1]In order to clarify exposition, the following definition of terms will be used during the remainder of this study. A block will refer to a group of shipments made on the same day. This refers (except one of two shipments) to four shipments. These shipments were kept in individual lots on the farm prior to shipment and, as explained earlier, the shipments within a block were as close to identical as practical. The composite price was discussed in an earlier section, page 69.

X_{24} = a variable to measure the price difference between the average composite value or price of all shipments and the actual composite value of a particular shipment. This variable measures the price difference between shipments within a block of four shipments.

X_{35} = variable X_{24} times X_{17}, this variable should indicate, if the composite value of shipment changes, how composite value effects the returns from markets A and markets B.

X_{36} = variable X_{24} times X_{18}, which measures how composite value affects the return from the markets.

X_{37} = variable X_{24} times X_{25} which measures the change in composite value affects the returns from markets C_4 and C_5.

The factors $b_6(X_1)$ through $b_{16}(X_{16})$ were dummy variables for blocks since they do not contribute any to explanation of the data other than the difference in price level between shipments, their values will not be included in the tables.

Table 4 includes the values for X_{17}, X_{18}, X_{19}, X_{20}, X_{25}, X_{24}, X_{35}, X_{36}, and X_{37} irrespective of the dependent variable used, the b values will be given for each respective regression in later tables.

Table 4. Tabular values of X's for both X_1 and X_2 dependent variables

Markets	X_{17}	X_{18}	X_{19}	X_{20}	X_{25}	X_{24}	X_{35}	X_{36}	X_{37}
A_1	-1	1	1	0	0	1	$-D^a$	D^a	0
A_2	-1	1	-1	0	0	1	$-D^a$	D^a	0
B_3	1	1	0	1	0	1	D^a	D^a	0
B_6	1	1	0	-1	0	1	D^a	D^a	0
C_4	0	-2	0	0	1	1	0	$-2D^a$	D^a
C_5	0	-2	0	0	-1	1	0	$-2D^a$	$-D^a$

[a]D represents the difference between average composite value and actual composite value.

The Analysis of the Combined Data Using Market Weight Price

Various independent or explanatory variables were included or excluded from the regressions to determine which were the most relevant to use when estimating hog price differences or price responsiveness of markets.

The regression developed using dependent X_1 (market weight price) includes all the explanatory variables, equation (1). The b values which were significant at the .01 level were b_{17}, b_{18}, b_{25}, b_{36}, b_{37}; b_{35} was significant at the .05 level. The analysis of variance, R^2, and the standard error are contained in Table 5 and the b values and standard errors of b in Table 6.

Table 5. ANOV, R^2, F ratio and standard error for equation [1]

Source	D.F.	Sum squares	Mean square
Regression	20	0.004966	0.000248
Residual	25	0.000128	0.000005
Total	45	0.005094	

F ratio = 48.3 Multiple R^4 = 0.9747

Standard Error 0.00226

Table 6. Value of a, b values, standard errors of b for equation [1]

a = $0.1510 per pound of hog

b subscript designation	b value	Standard error of b
6	0.0106	0.0076
7	0.0046	0.0058
8	0.0053	0.0054
9	0.0040	0.0041
10	0.0044	0.0034
11	-0.0006	0.0023
12	-0.0040	0.0041
13	-0.0035	0.0038
14	-0.0044	0.0053
15	-0.0028	0.0049
16	-0.0068	0.0047
17	0.0030** [a]	0.0004
18	0.0018**	0.0003
19	-0.0000	0.0006
20	0.0004	0.0006
24	0.4157	0.4925
25	-0.0040**	0.0006
35	0.1160*	0.0495
36	-0.0798**	0.0283
37	0.2396**	0.0567

[a] In this table and hereafter all reference to significant levels shall be indicated as follows: * significant at .05 level and ** significant at .01 level.

The large R^2 obtained by using equation [1], means that when market weight price was used as dependent variable that most of the price variation between markets can be accounted for in the equation. Which means very little price variation was due to factors not included in the regression. The variable or factor $b_{24}(X_{24})$ accounts for the price trend over time or the change in composite value and was not significant in equation [1]. The next step in the analysis was to drop it out of the equation. Thus equation [2]:

$$X_1 = a + b_6(X_6) + \cdots + b_{20}(X_{20}) + b_{25}(X_{25}) + b_{35}(X_{35}) + b_{36}(X_{36}) + b_{37}(X_{37}) \quad [2]$$

Excluding $b_{24}(X_{24})$ from the regression caused the following b values to become significant at the .01 level, $b_6 \cdots b_{18}$, b_{25}, b_{36}, b_{37}. See Table 8 for the b values and standard errors of b for equation [2]. The only significant b coefficients in equation [1] were b_{17}, b_{18}, b_{25}, b_{36}, and b_{37} at the .01 level and b_{35} at the .05 level (Table 6). The fact that the coefficients for block affect b_6 through b_{16} became significant indicates that if price level was not included in the analysis, price difference found between markets would be very small. However, it can be noted that the exclusion of the factor $b_{24}(X_{24})$ did not materially lower the R^2 (see Table 7).

Table 7. ANOV, R^2, F-ratio and standard error for equation [2]

Source	D.F.	Sum squares	Mean square
Regression	19	0.004962	0.000261
Residual	26	0.000132	0.000005
Total	45	0.005094	

F ratio = 51.38 Standard error 0.00225

Multiple R^2 = 0.9740

Table 8. Value of a, b values, standard errors of b for equation [2]

a = $0.1510 per pound of hog

b subscript designation	b value	Standard error of b
6	0.0169**	0.0012
7	0.0093**	0.0011
8	0.0097**	0.0011
9	0.0073**	0.0011
10	0.0071**	0.0011
11	0.0008	0.0016
12	-0.0073**	0.0011
13	-0.0065**	0.0011
14	-0.0087**	0.0011
15	-0.0069**	0.0011
16	-0.0107**	0.0011
17	0.0031**	0.0004
18	0.0017**	0.0002
19	-0.0000	0.0006
20	0.0004	0.0006
25	-0.0039**	0.0006
35	0.1276**	0.0473
36	-0.0925**	0.0238
37	0.2444**	0.0561

The next step taken in the analysis was to drop factors $b_{24}(X_{24})$, $b_{35}(X_{35})$, $b_{36}(X_{36})$ from the original equation |1|.

[3] $X_1 = a + b_6(X_6) + \cdots + b_{20}(X_{20}) + b_{25}(X_{25})$.

These factors were dropped from the original equation to determine if the composite price variation within markets were small enough to exclude them from the regression. All of the b coefficients of equation [3] became significant at the .01 level except b_{11}, b_{19}, and b_{20}, which were essentially the same as those found in equation [2] (see Table 9). The R^2 in the regression of equation [3] was reduced and the standard error increased from the preceding regression, hence not as good a fit (see Table 10).

Continuing with the simplification of the regression, the factors $b_{35}(X_{35})$, $b_{36}(X_{36})$, $b_{37}(X_{37})$ were next excluded from the original regression. The $b_{24}(X_{24})$ was reintroduced into the equation. These changes were made to find a better fit to the regression. The regression from equation [3] increased the R^2 to 0.9259 but it also raised the standard error to 0.00315 (Table 11). The significant b coefficients were b_{17}, b_{18}, b_{24}, and b_{25}, (Table 12).

The final equation excluded all dummy variables $b_6(X_6)$ through $b_{16}(X_{16})$ but includes all other variables.

Table 9. The value of a, b values, standard errors of b for equation [3]

a = $0.1510 per pound of hog		
b subscript designation	b value	Standard error of b
6	0.0167**	0.0017
7	0.0087**	0.0017
8	0.0109**	0.0017
9	0.0077**	0.0017
10	0.0072**	0.0017
11	0.0005	0.0024
12	-0.0078**	0.0017
13	-0.0060**	0.0017
14	-0.0090**	0.0017
15	-0.0070**	0.0017
16	-0.0113**	0.0017
17	0.0030**	0.0007
18	0.0016**	0.0003
19	-0.0024	0.0010
20	0.0005	0.0010
25	-0.0035**	0.0009

Table 10. ANOV, R^2, standard error and F ratio for equation [3]

Source	D.F.	Sum squares	Mean square
Regression	16	0.004735	0.000295
Residual	29	0.000359	0.00001
Total	35	0.005094	

F ratio = 23.90 Standard error 0.00351

Multiple R^2 = 0.9295

Table 11. ANOV, R^2, standard error and F ratio for equation [4]

Source	D.F.	Sum squares	Mean square
Regression	17	0.0048	0.000315
Residual	28	0.0003	
Total	45	0.0051	

F ratio = 28.46 Standard error 0.00315

Multiple R^2 = 0.9452

Table 12. The value of a, b values, standard errors of b for equation [4]

a = $0.1510 per pound of hog

b subscript designation	b value	standard error of b
6	-0.0072	.0086
7	-0.0092	.0065
8	-0.0060	.0061
9	-0.0051	.0048
10	-0.0033	.0040
11	-0.0046	.0029
12	0.0049	.0048
13	0.0056	.0044
14	0.0074	.0060
15	0.0077	.0057
16	0.0037	.0055
17	0.0027**	.0006
18	0.0020**	.0004
19	-0.0002	.0009
20	0.0004	.0009
24	1.5723*	.5537
25	-0.0042**	.0009

$$X_1 = a + b_{17}(X_{17}) + b_{18}(X_{18}) + b_{19}(X_{19}) + b_{20}(X_{20}) + b_{25}(X_{25}) + b_{24}(X_{24}) + b_{35}(X_{35}) + b_{36}(X_{36}) + b_{37}(X_{37}). \quad [4]$$

Table 13 and Table 14 include the ANOV, R^2, standard error, b values and standard errors of b.

The next step was to exclude X_{35}, X_{36}, X_{37} and to retain X_{24} to see if this equation would give any gain in fit. The following equations would be:

The regression increasing the R^2 to 0.9452 but standard error was higher, (0.00315) than the regression which included all factors, which had a standard error of 0.0022, (Tables 11 and 12).

So, in the final regression all the dummy variables X_6 through X_{16} were excluded leaving the variables X_{17}, X_{18}, X_{19}, X_{20}, X_{25}, X_{24}, X_{35}, X_{36}, X_{37}. The following would be the regression without the dummy variables.

$$X_1 = a + b_{17}(X_{17}) + b_{18}(X_{18}) + b_{19}(X_{19}) + b_{20}(X_{20}) + b_{25}(X_{25}) + b_{24}(X_{24}) + b_{35}(X_{35}) + b_{36}(X_{36}) + b_{37}(X_{37}). \quad [5]$$

See Tables 13 and 14 for ANOV and b values.

Table 13. ANOV, R^2, standard error and F ratio for equation [5]

Source	D.F.	Sum squares	Mean square
Regression	9	0.004873	0.000541
Residual	36	0.000221	0.000006
Total	45	0.0005094	

F ratio = 88.35 Standard error = 0.00247

R^2 = 0.9567

Table 14. The value of a, b values, standard errors of b for equation [5]

a = $0.1510 per pound of hog

b subscript designation	b value	standard error of b
17	0.0027**	0.0004
18	0.0018**	0.0002
19	-0.0001	0.0006
20	0.0006	0.0006
24	0.9453**	0.0374
25	-0.0039**	0.0006
35	0.0550	0.0480
36	-0.0839*	0.0252
37	0.2086**	0.0583

Final regression

The regression of equation [5] did not give as good a fit as did the regression containing the variables for block effects. However, the simpler regression could be used to estimate price differences and price responses. Also, the inclusion of the composite price in the regression removes almost all of the block effects.

Inserting the X values from Table 4 and the b values from Table 14 into equation [5] a price estimate can be made for each type of market.

Where a = Mean of Market Weight Price

D = Difference between composite value and average composite value of 46 shipments.

A = Terminal Market Weight Price

B = Rail Market Weight Price

C = Live Market Weight Price

$$[6]\quad A = a + b_{17}(X_{17}) + b_{18}(X_{18}) + b_{24}(X_{24}) + b_{35}(X_{35}) + b_{36}(X_{36}).$$

The terms $b_{20}(X_{20})$, $b_{25}(X_{25})$, $b_{37}(X_{37})$ dropped from equation [6] because the X values were zero for these terms, (Table 4). The term $b_{19}(X_{19})$ was excluded because the b coefficient (b_{19}) of that was not significant at the .05 level (Table 14). The nonsignificances of coefficient b_{19} meant that there was no price difference between terminal

markets A_1 and A_2. Only one equation will be used for terminal markets.

$$[7] \quad B = a + b_{17}(X_{17}) + b_{18}(X_{18}) + b_{24}(X_{24}) + b_{35}(X_{35}) + b_{36}(X_{36}).$$

The terms $b_{19}(X_{19})$, $b_{25}(X_{25})$, $b_{37}(X_{37})$ were excluded from equation [7] because the X values were zero for these terms, (Table 4). The term $b_{20}(X_{20})$ was excluded because the b coefficient (b_{20}) of that factor was not significant at the .05 level (Table 4). The nonsignificance of b_{19} meant that there was no price difference between the two carcass grade and yield markets, B_3 and B_6. Therefore, only one regression equation will be used for B markets.

$$[8] \quad C = a + b_{18}(X_{18}) + b_{25}(X_{25}) + b_{24}(X_{24}) + b_{36}(X_{36}) + b_{37}(X_{37}).$$

The terms $b_{17}(X_{17})$, $b_{19}(X_{19})$, $b_{20}(X_{20})$ were excluded from equation [8] because the X values for these factors were zero (Table 14). Separate regression equations were used for the two live sort markets, C_4 and C_5, because there was a significant difference between the C markets. Note the significance of b_{25} at the .01 level in Table 14.

The following multiple regression equations were developed by substituting values from Tables 4 and 14 into the

equations 6, 7, and 8 respectively.

$$A = 0.1510 + (0.0027)(-1) + (0.0018)(1) + (0.9453)(D) + (0.0549)(D) + (-0.0839)(D) = \underline{0.1501 + (0.8064)D}$$

$$B = 0.1510 + (0.0027)(1) + (0.0018)(1) + (0.9453)(D) + (-0.0839)(D) = \underline{0.1555 + (0.9164)D}$$

Since the b_{19} coefficients for C_4 and C_5 are significantly different, separate equations were developed

$$C_4 = 0.1510 + (0.0018)(-2) + (-0.0039)(1) + (0.9453)(D) + (-0.0839)(D)(-2D) + (0.2086)(D) = \underline{0.1435 = 1.3217}\ D$$

$$C_5 = 0.1510 + (0.0018)(-2) + (-0.0039)(-1) + (0.9453)(D) + (-0.0839)(-2D) + (0.2086)(-D) = \underline{0.1513 + 0.9045}\ D$$

i.e.,

[9] $A = 0.1501 + (0.8064)\ D$

[10] $B = 0.1555 + (0.9164)\ D$

[11] $C_4 = 0.1435 + 1.3217\ D$

[12] $C_5 = 0.1513 + (0.9045)\ D$

The first term in the above equations represents the market weight price at the mean composite value. The term (D) in the above equations represents the difference between the mean composite value of a given shipment and the

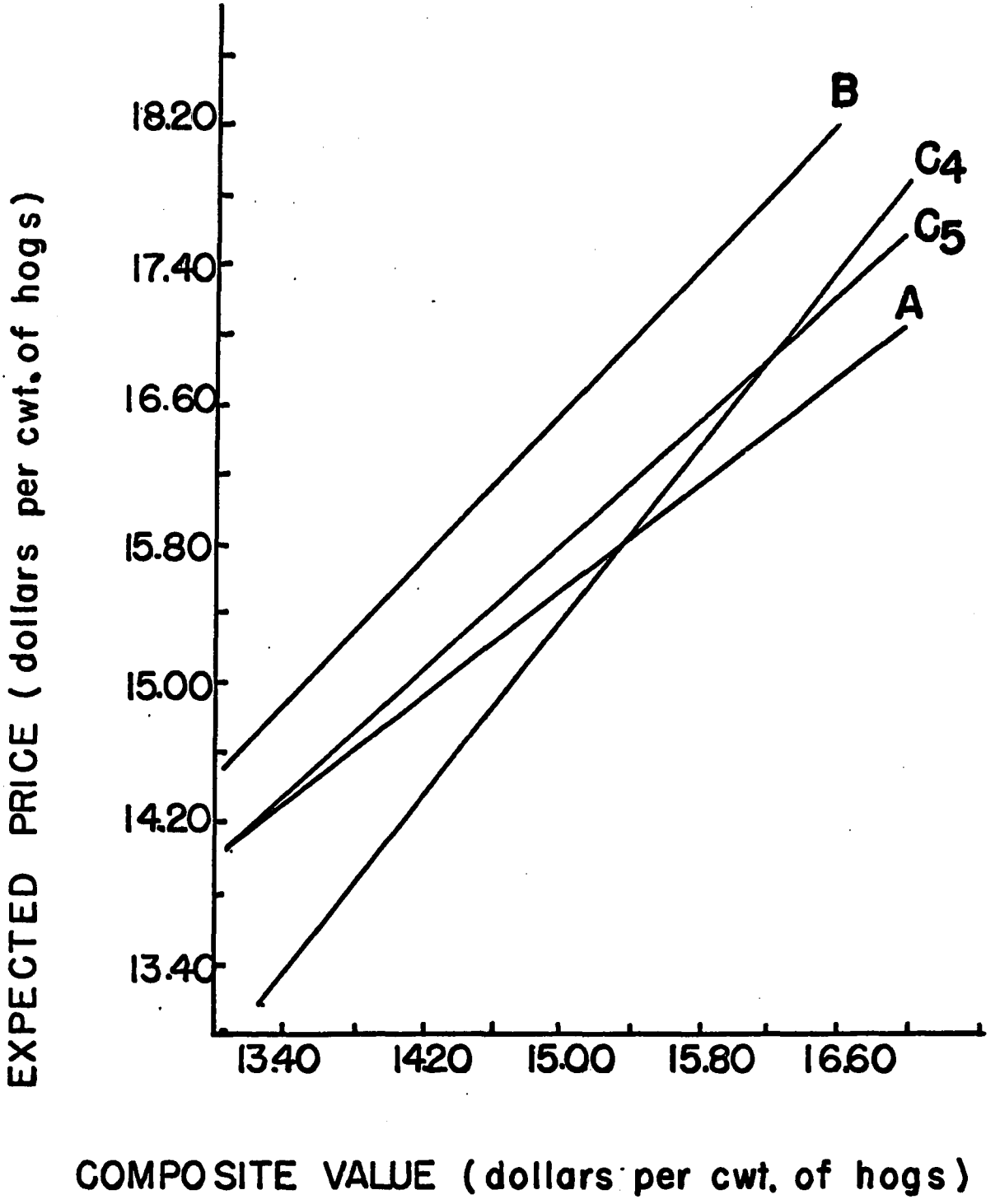
overall mean composite value. The term drops out when the composite value equals $0.1427 per pound or D = 0. Thus at the mean (composite value) the difference between the value of hogs sold at B(carcass grade and yield) markets ($0.1555 per pound) and terminal markets ($0.1501 per pound) was $0.0054 per pound or $0.54 per hundred weight. A value of $0.54 per hundred weight would make a 220 pound hog worth $1.19 more when sold on a carcass grade and yield market than when sold at a terminal market.

The price difference between B(carcass grade and yield) markets and C_4 (Fort Dodge) at the mean was $1.20 per hundred weight in favor of B. The price difference between B markets and C_5 was $0.12 per hundred weight, in favor of B. The hog price difference between A markets and the C_4 market, at the mean, was $0.66 per hundred weight, in favor of A. The price difference between A markets and the C_5 market was $0.12 per hundred weight in favor of C_5.

Plotting the regressions To plot the above regressions on a graph, one has a substitute different values for (D). Figure 9 illustrates these plotted regressions. The horizontal scale represents the composite value and the vertical scale represents the predicted or expected market weight price.

For example, if the composite value of a shipment were $0.1337 per pound, the price received for hogs sold at C_4

Figure 9. The price regressions at A, B, C_4, and C_5 markets (market weight analysis)


B
C4
C5
A
18.20
17.40
16.60
15.80
15.00
14.20
13.40
13.40
1420
15.00
15.80
16.60
EXPECTED PRICE (dollars per cwt. of hogs)
COMPOSITE VALUE (dollars per cwt. of hogs)

would be \$13.15 per hundred weight, from C_5 \$14.32 per hundred weight, terminal markets A \$14.30 per hundred weight, and from carcass grade and yield markets \$14.72. The differences found, at the mean composite value (\$13.37 per hundred weight), were as follows:

B - A = \$0.42 per cwt.

B - C_4 = \$1.57 per cwt.

B - C_5 = \$0.40 per cwt.

A - C_4 = \$1.15 per cwt.

C_5 - A = \$0.02 per cwt.

C_5 - C_4 = \$1.17 per cwt.

If the composite value of a shipment was increased to \$14.47 per hundred weight the following difference in expected market weight prices would occur.

B (\$16.65 per cwt.) - A (\$15.97 per cwt.) = \$0.78 per cwt.
B " " " - C_4(\$15.97 " ") = \$0.78 " "
B " " " - C_5(\$16.07 " ") = \$0.58 " "
A (\$15.97 " ") - C_4(\$15.97 " ") = \$0.00 " "
C_5(\$16.07 " ") - A (\$15.97 " ") = \$0.10 " "
C_5(" " ") - C_4(\$15.97 " ") = \$0.10 " "

One can observe both from the above equations and the regressions in Figure 8, that the C_4 market was the most price responsive. Its market price increased \$1.32 per hundred weight for each \$1.00 increase in composite value. The terminal markets A were the least responsive, they increased

only $0.81 per hundred weight for each $1.00 per hundred increase in composite value. The C_5 market increased market prices $0.90 per hundred weight for each $1.00 increase in composite shipment value. The carcass grade and yield markets increased $0.92 per hundred weight for each $1.00 increase in composite value.

Even though the C_4 market was the most responsive to changing composite value, it was only at a relatively high composite value (i.e., $15.47 per hundred weight) that the C_4 market price approached the prices paid at other markets.[1]

Figures 10 through 13 contain the regressions with market weight prices received plotted against actual composite

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[1]Observation of market prices of hogs received at C_4 helps provide the primary reason for C_4 to be significantly different from C_5. C_4 practiced heavy price discrimination against light hogs during the second marketing period, but did not discriminate very much during the first marketing period. However, prices during the first period were higher and hog supplies were somewhat smaller, making it more difficult to obtain sufficient supplies of hogs. But C_4 did discriminate heavily those hogs weighing under 190 pounds during the second marketing period. It could not be determined exactly why C_4 reduced prices when the other markets did not. Apparently, C_4 had little use for light hogs and was trying to discourage their shipment. The unexplained heavy discrimination of certain types of hogs does create one of the uncertainties producers must contend with when marketing hogs. They must be able to learn and detect when markets are not pricing hogs competitively. Producers that recognize this can shift their hog sales to higher paying markets. Just because C_4 was not price competitive with the other markets when buying on a live basis does not mean they are not competitive when buying by other methods. C_4 does buy hogs on a carcass grade and yield basis.

Figure 10. Market A price regression and actual prices plotted against composite value

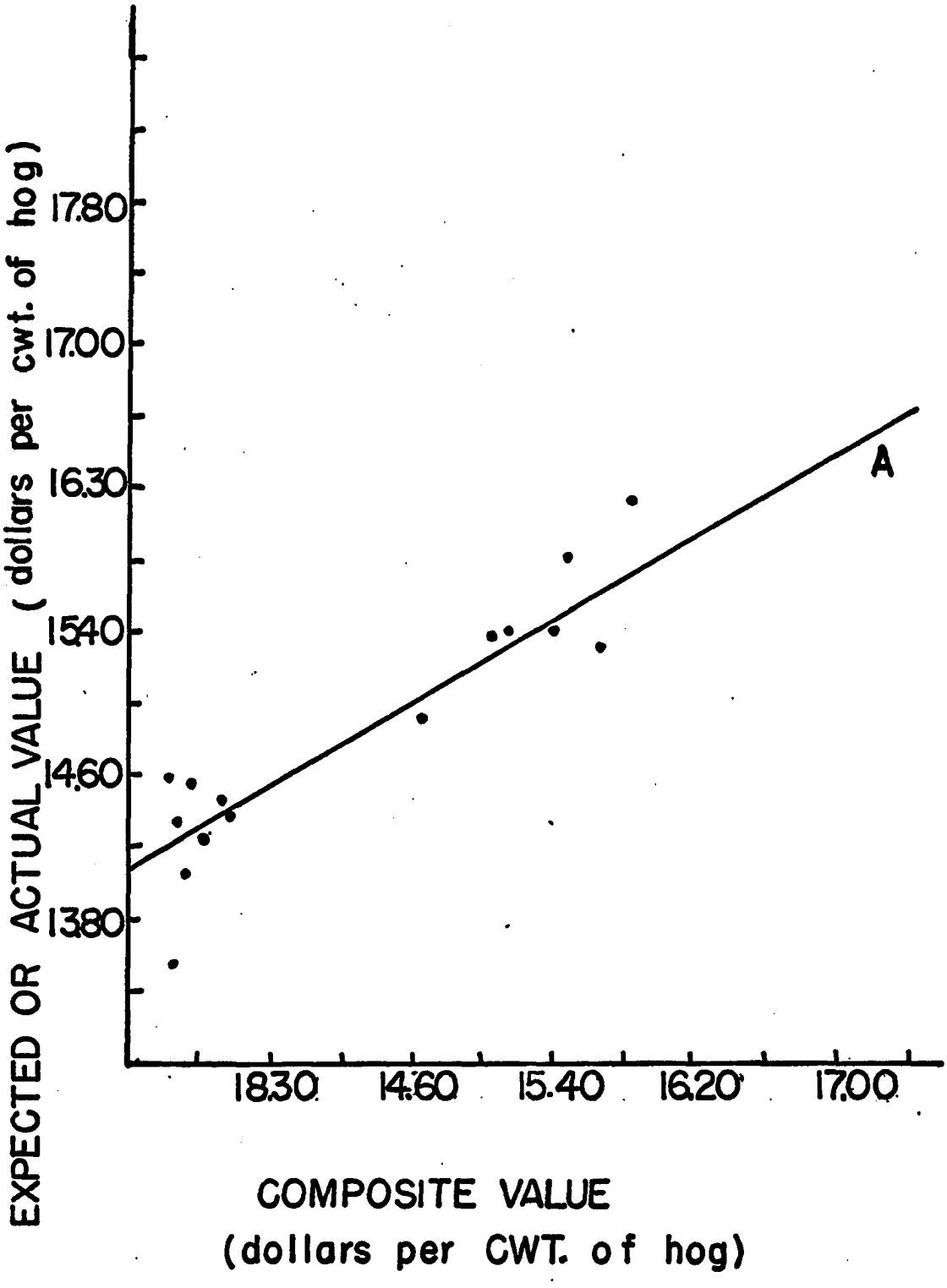

EXPECTED OR ACTUAL VALUE (dollars per cwt. of hog)
17.80
17.00
16.30
15.40
14.60
13.80
A
18.30
14.60
15.40
16.20
17.00
COMPOSITE VALUE
(dollars per CWT. of hog)

Figure 11. Market B price regression and actual prices plotted against composite value

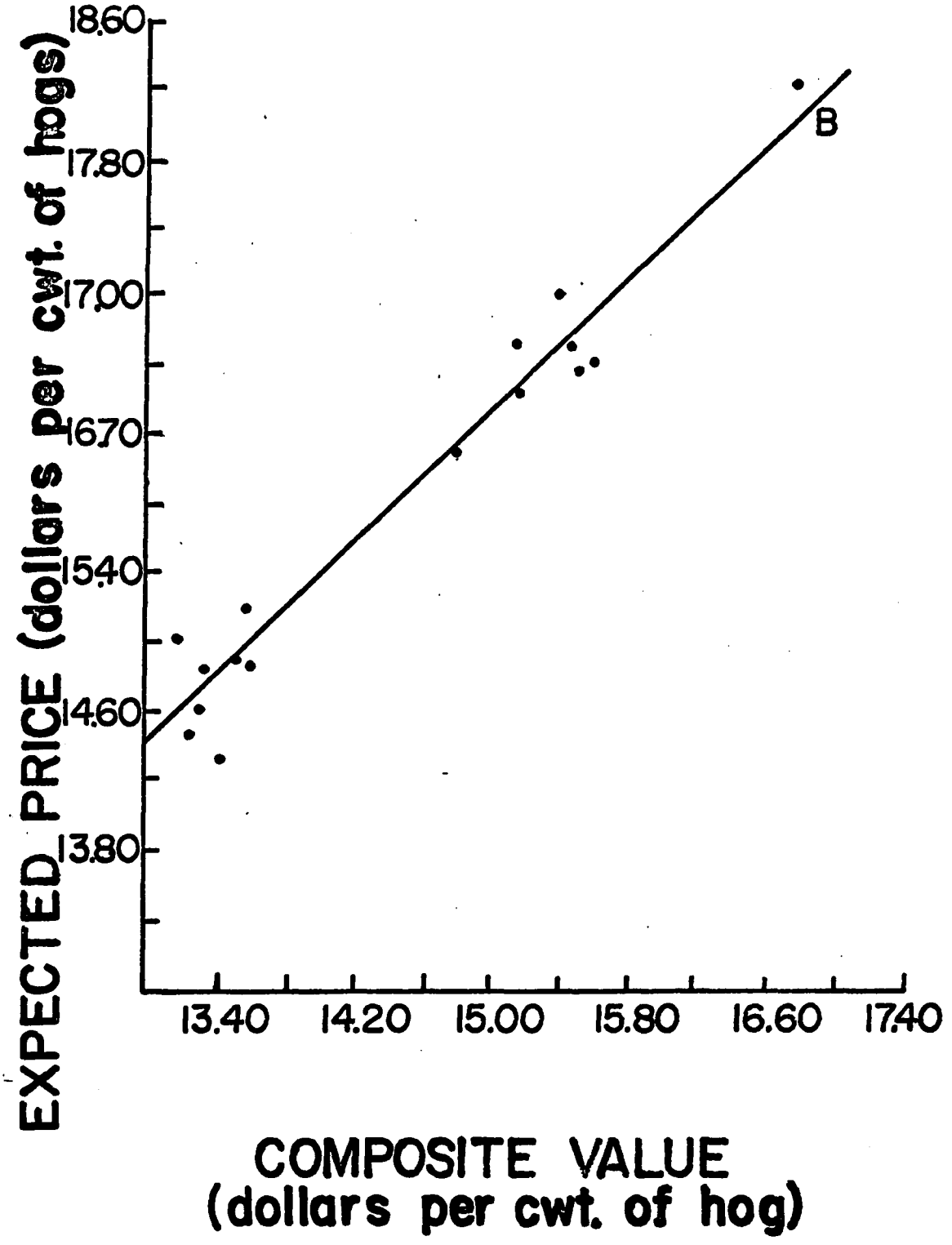

18.60
17.80
17.00
16.70
15.40
14.60
13.80
EXPECTED PRICE (dollars per cwt. of hogs)
B
13.40
14.20
15.00
15.80
16.60
17.40
COMPOSITE VALUE
(dollars per cwt. of hog)

Figure 12. Market C_4 price regression and actual prices plotted against composite value

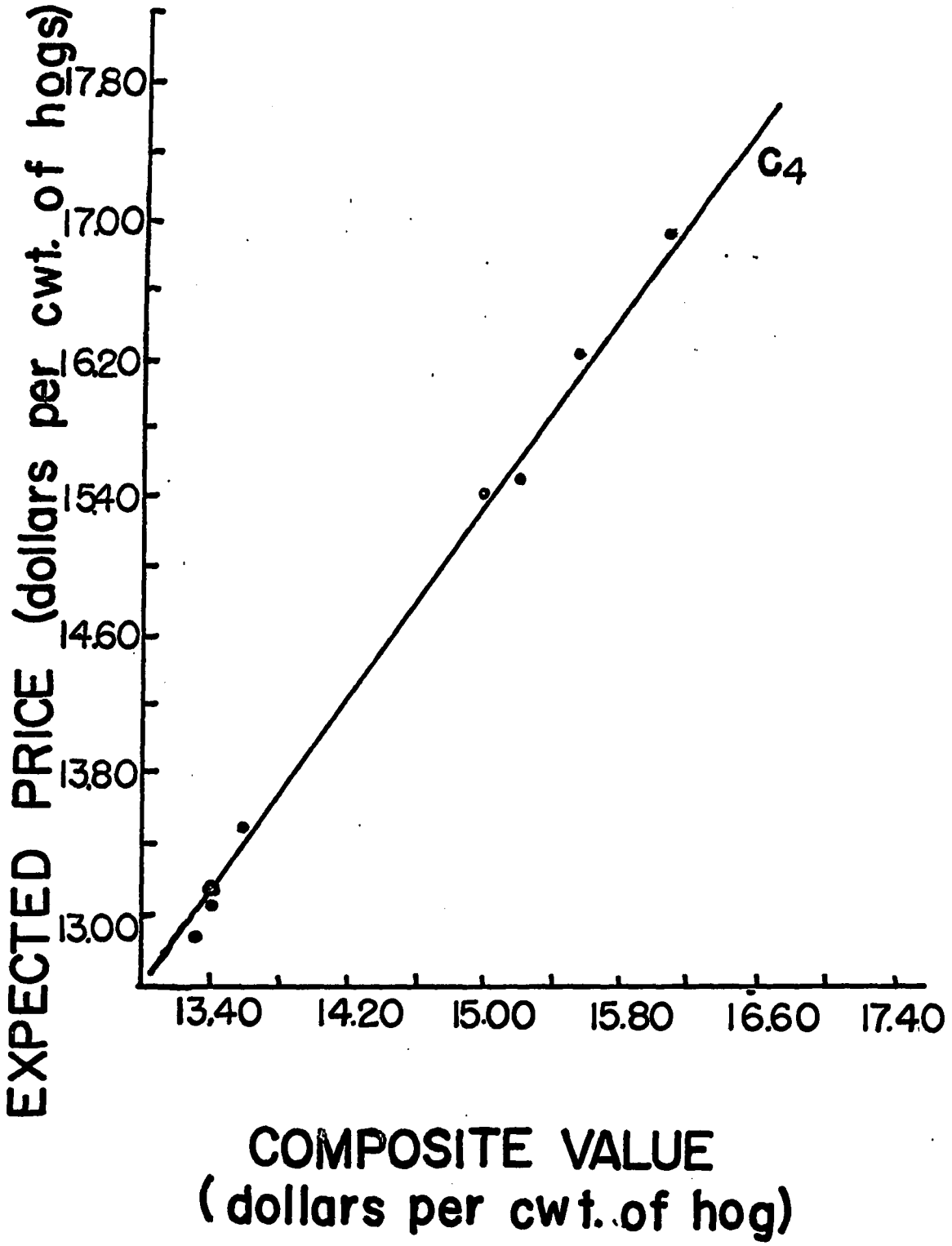
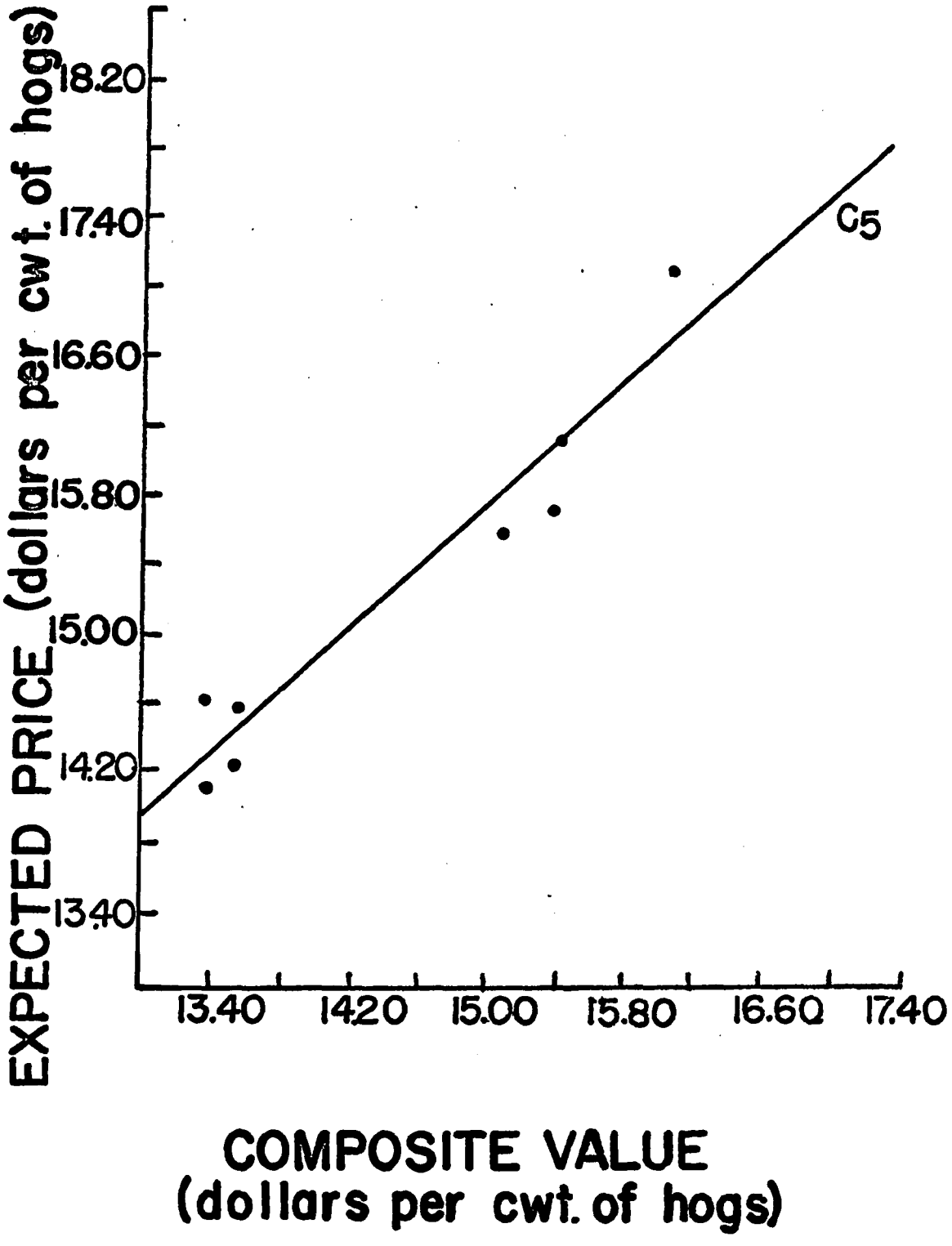

EXPECTED PRICE (dollars per cwt. of hogs)
17.80
17.00
16.20
15.40
14.60
13.80
13.00
C4
13.40
14.20
15.00
15.80
16.60
17.40
COMPOSITE VALUE
(dollars per cwt. of hog)

Figure 13. Market C_5 price regression and actual prices plotted against composite value


EXPECTED PRICE (dollars per cwt. of hogs)
18.20
17.40
16.60
15.80
15.00
14.20
13.40
C5
13.40
14.20
15.00
15.80
16.60
17.40
COMPOSITE VALUE
(dollars per cwt. of hogs)

values. Figure 10, terminal markets, Figure 11, carcass grade and yield markets, Figure 12, live interior market C_4, and Figure 13, live interior market C_5.

A second dependent variable (X_2) was regressed against the same independent variables as was X_1. Dependent variables X_2 represents the price per pound based on the original weight of the hogs.

As mentioned earlier, the use of market weight price in determining price per pound differences between markets makes the implied assumption that the hogs were not shipped but were located on each particular market for which prices were recorded.

If a producer were to use data from this study, he would have to estimate the transportation cost and shrink loss from his farm to a particular market. The transportation charge and shrink loss would have to be deducted, which would give him a lower return than that found in this study. The more distant a producer was from the market, the larger the deduction. A producer must note marketing charges, they have already been deducted. Any change in marketing charges, by the terminal markets, would have to be included in the estimation of final net price.

Analysis Using Original Weight Price

Terminal markets may feel that this study was biased against them. Most terminal markets feed their hogs prior to sale, while other markets do not. Therefore, an analysis based on market weight price would not measure the additional weight hogs had gained on their market. Terminal markets may contend that any price advantage other markets have would be offset by smaller market weight of the hogs.

Hogs actually lose some weight while being transported to market. Based on previous research, most of the weight lost during shipment was fill loss rather than tissue shrink. Therefore, only if the hogs were shipped extremely long distances would any tissue shrink take place. Fill loss does not reduce the hog cut out value, but it does reduce the weight of the hog. Terminal markets claim, that even though hogs lose weight during transit to their markets, the feed they provide regains a considerable portion of the intrasit weight loss (29).

Assuming the preceding statement was correct, then terminal markets would be discriminated against when they are compared with other markets on a market weight price basis.

The data were reanalyzed using original weight price as the dependent variable. An analysis using original weight price should give those markets that were nearest to the AEC farm and those that fed hogs at the market an advantage.

Those markets which hogs were shipped the furtherest distance and did not feed should be the lowest priced markets. Therefore, X_2 was substituted for X_1 in equation [5] and regressed against the independent variables.

$$X_2 = a + b_{17}(X_{17}) + b_{18}(X_{18}) + b_{19}(X_{19}) + b_{20}(X_{20}) + b_{24}(X_{24}) + b_{25}(X_{25}) + b_{35}(X_{35}) + b_{36}(X_{36}) + b_{37}(X_{37}). \quad [13]$$

Table 15 contains the ANOV, R^2, standard error and F ratio of this regression and Table 16 contains the values of the b coefficients and standard errors of b.

Although the R^2 (0.9479) from equation [13] is not as large as that found in equation [5], $R^2 = 0.9567$, the difference is not great.

Table 15. ANOV, R^2, standard error and F ratio for equation [13]

Source	D.F.	Sum squares	Mean square
Regression	9	0.00593	0.000658
Residual	36	0.00032	0.000009
Total	45	0.006250	

F ratio = 72.89 Standard error = 0.0030

Multiple R^2 = 0.9479

Table 16. The value of a, b values, standard erros of b for equation [13]

a = $0.1461 per pound of hog		
b subscript designation	b value	Standard error of b
17	0.0039 **	0.0006
18	0.0016 **	0.0003
19	-	0.0008
20	0.0008	0.0008
24	1.0443 **	0.0454
25	-0.0036 **	0.0008
35	0.1099	0.0583
36	-0.0681 *	0.0306
37	0.2776 *	0.0708

The X values are located in Table 4, they are the same values as those used for X_1.

All b's were significant at the .01 level except b_{19}, b_{20}, b_{35}, b_{36} but b_{36} is significant at the .05 level and b_{35} approaches it. The data of this regression also indicated b_{20} and b_{19} not significant that there was no significant difference between the two B markets and between the two A markets. Even though the standard errors for both b_{35} and B_{36} were relatively large, they were used to develop the regression equation for A, B, C_4 and C_5 markets.

a = 0.1460

D = Difference between average composite value and composite value

A = 0.1460 + (0.0039)(-1) + (0.0016)(1) + (1.0443)(0)

$$+ (0.1099)(-D) + (-0.0681)(D) +$$

$$= 0.1437 + 0.8663\ D$$

$$B = 0.1460 + (0.0039)(1) + (0.0016)(1) + (1.0443)(D)$$
$$+ (-0.0681)(D)$$
$$= 0.1515 + (1.0861)\ D$$

$$C_4 = 0.1460 + (0.0016)(-2) + (-0.0036)(1)$$
$$+ (1.0443)(D) + (-0.0681)(-2D) + (0.2776)(D)$$
$$= 0.1392 + 1.4580\ D$$

$$C_5 = 0.1460 + (0.0016)(-2) + (-0.0036)(-1)$$
$$+ (1.0443)(D) + (-0.0681)(-2D) + (0.2776)(-D)$$
$$= 0.1464 + (0.9029)\ D$$

Collecting terms, equations [14], [15], [16], and [17] were developed.

[14] $A = 0.1437 + 0.8663\ D$

[15] $B = 0.1515 + 1.0861\ D$

[16] $C_4 = 0.1392 + 1.4580\ D$

[17] $C_5 = 0.1464 + 0.9029\ D$

The terminal market prices found using the X_2 dependent variable were compared with those found using the X_1 variable, because the earlier analysis might have disadvantaged it most.

The difference between markets A and markets B (i.e., equation [15] -- equation [14]) at the mean composite value (i.e., D = 0, thus second term drops out) was (0.1515 -

0.1437) $0.78 per hundred weight in favor of the B markets. Whereas the regression using equation [5] the difference was only $0.54 per hundred weight between these two markets, in favor of the B market. This means, that when using the original weight price, the terminals appeared lower priced than they did when using the market weight price in the analysis. However, the B markets are located closer to the Bisland farm, therefore, hogs shipped to the B markets presumably would not have lost as much weight as would the hogs shipped to the terminal markets. A better comparison might have been made with the C_5 market, it was located 120 miles from the farm and A_1 was 169 miles and A_2 was 148 miles. Therefore, the difference between the distances was not great enough to provide much different shrink loss. The comparison of A markets with C_5 might indicate more exactly if the A markets were discriminated against in the earlier analysis. The price difference between A and C_5, using variable X_2 (equation [17]) -- equation [18]) was $0.27 per hundred weight in favor of C_5, but when using variable X_1, the difference was only $0.12 per hundred weight in favor of the C_5 market.

One can conclude from this that the terminals were not put at a disadvantage because of greater weight sold or shrink. The analysis using market weight price makes terminals appear more favorable than they do using the original weight price analysis.

Plotting the regressions

Values were substituted for (D) in the equations [14], [15], [16], and [17] to plot the regressions for each of the markets. Figure 14 shows these regressions.

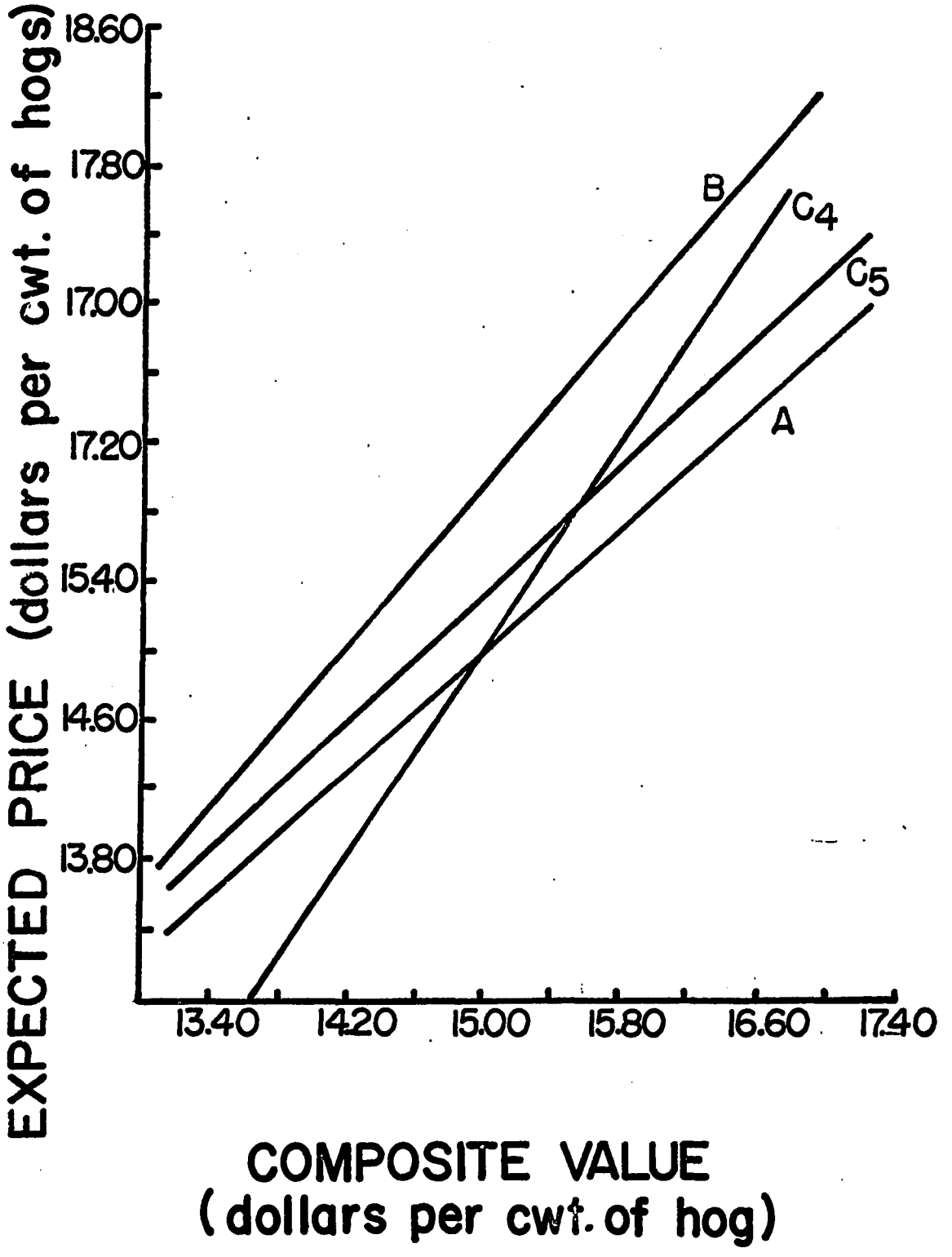
All of the markets were more responsive, except C_5, to changing composite prices using the X_2 variable than they were when using X_1. All of the mean prices of the markets were lower using the X_2 variable than they were with X_1. This could be expected because all hogs (except two shipments) lost weight during shipment between the time they were weighed and the time they were sold.

The preceding analysis indicated that terminal markets were not disadvantaged by the analysis using market weight price as a value factor. The X_2 variable was regressed the same independent variables as were the results, in all cases, were essentially the same as compared above. The analysis using X_2 variable will not be discussed further as its ceofficients were affected by the variable loss or gain in weight that occurred during transit and prior to shipment to a market.

Composite prices

Before proceeding further with the analysis, it might be helpful to clear up some points. The various market price responses to changing composite values (using market weight

Figure 14. The price regressions at A, B, C_4, and C_5 (original weight analysis)


EXPECTED PRICE (dollars per cwt. of hogs)
18.60
17.80
17.00
17.20
15.40
14.60
13.80
B
C4
C5
A
13.40
14.20
15.00
15.80
16.60
17.40
COMPOSITE VALUE
(dollars per cwt. of hog)

price) have, with the exception of market C_4, been less than 1.0. That is, the second factor in the regression equations (i.e., A = 0.1501 + 0.8064D) .8064 is less than 1.0. What type of response should be expected? To determine the proper response, it will be important to determine what conditions are necessary to obtain a 1.0 response.

(1) There was no quality evaluation of these hogs, neither during the first or second marketing period. If there were different qualities of hogs (in total) between the first and second marketing period, how would this affect the response curves? (a) If the quality of hogs were higher during the first marketing or observation period, one would expect the response curve to be less than 1.0 (if 1.0 is considered to be the response when there is equal quality throughout the study). (b) If the hog quality was higher during the second marketing period, one would expect the response curves to be less than 1.0.

Quite often, especially when hogs are purchased live, buyers use weight as one measure of quality. The mean weight of the hogs for the first period was 204.4 pounds per hog and during the second period it was 197.5 pounds per hog. If there were some tendency to judge quality by weight, then the quality as assessed by the market personnel would be less for the second marketing period, how much less cannot be established. Thus, if the quality of hog were lower

during the second period, it would give some reason to expect a response of less than 1.0.

(2) In order to expect a 1.0 response, the markets, which were averaged to determine the composite value, must be competitors with those markets to which hogs were sold. If the markets were not pure competitors, then the response curve can depart from the expected 1.0. Also, the markets must be equally competitive at all price and supply ranges. For example, one might argue that the reason C_4 market has a greater than 1.0 response (1.3217) was the supply of hogs was large (such as was the case during the second marketing period, when prices were lower) enough that it did not have to be competitive to obtain hogs. One might reason that because of some certain locational advantages, C_4 received sufficient supplies from around their plant, without affecting their competitors supply. But, during shorter supply periods (such as during the first marketing period) C_4 had to be more competitive to obtain enough hogs to maintain current processing requirements.

(3) Another factor which must exist to have a 1.0 response is that market price quotations (which were used to make up the composite price) must be equal to the actual prices paid on the market.

What relationship does the composite value of a shipment have to actual prices received by farmers? Does it represent

changing prices? Could one assume that as composite prices increase, prices on the market increase?

To a limited extent this was true, but one cannot know what the ideal response should be, this would be possible only if there were one market which reflected accurately, at all times, the changing demand and supply relationship of pork and other meat commodities. It would have to be a market that would completely fit the pure competitive market framework. It would be a firm that had complete knowledge of the market but was not large enough to influence market prices. It could not have any locational advantage, clearly, there is no one market which has all these characteristics. Most packing plants approach this ideal to a large degree, but the departations from it are sufficient to prevent the selection of one. Therefore, only the relativeness of the response to changing composite values or prices could be examined, and the statement earlier made that as composite values increase, market prices also increase.

Analysis of Weight Loss to Market

The data obtained from this study were in a form that it could be used to estimate weight loss during shipment to market. Therefore, an attempt was made to analyze weight loss. Analysis of weight loss could support or refute the analysis made using the X_2 variable data when it was compared

to the X_1 variable data. The hogs, in this study, originated from the ISU farm at Madrid, Iowa. The distance from the farm to each market was different, they are as follows: A_1 = 169 miles, A_2 = 148 miles, B_3 = 31 miles, B_6 = 37 miles (to the point where the hogs were weighed), C_4 = 70 miles, C_5 = 120 miles.

There are many factors which affect weight loss during shipment to market. Some of these factors are: Distance from the market, temperature during shipment, weather conditions, type of hogs and method of handling during loading. Previous studies have found it difficult to isolate the relevant variables. Even if each factor could be isolated, this would not account for the influence each factor has on other factors. Studying each factor separately would not be very beneficial. During this study, the hogs were sorted into four separate lots so that each lot had an equal number of hogs in each weight group. The hogs were weighed prior to movement into the holding pens, therefore, weights were not taken at the time of shipment, but during the sorting process. Some hogs were held in the holding pens for over a weekend, causing some change in weight of the lot prior to shipment.[1] But, each lot within a block had an equal number

[1]An attempt was made to obtain the weight of a lot just prior to shipment. The trucks, prior to loading and just after loading, were weighed at the closest truck scale, near the farm. But due to the difficulty in controlling various factors, which affect truck weights such as collection of mud, snow, and gasoline fill of the truck, this procedure was dropped.

of hogs held between weighing and shipment.

The method of weighing made it impossible to determine weight loss during shipment. Weight loss during shipment would be valuable information to producers shipping hogs. However, the analysis of the weight data in this study could be used to determine weight loss between markets. That is, one can compare how much more weight was lost at the more distant markets than was lot at the nearer markets.

The method of analyzing this data was the same as that used when price difference was analyzed. Average shrink loss between markets indicated as high as 2 percent greater shrink loss to some markets, but the regression analysis could find no significant difference in weight loss between markets either at the .01 or .05 level. Summary data for shrink analysis are contained in Appendix B, Tables 25 and 26.

The shrink study had some definite limitations but it did control more factors than most previous studies, yet, there was sufficient variation in weight loss within shipments to a given market to render the data statistically nonsignificant. If one had been able to isolate more factors such as temperature during shipment and time in transit, it might have been possible to obtain meaningful results.

The results of the weight loss analysis supports that found when comparing the X_1 and X_2 variable data. Had a

significant intransit weight loss been found, the analysis using the X_2 variable would have been more valid than using the X_1 variable.

The data derived from using the x_1 dependent variable (market weight price) seem the most valid when used in comparing markets and marketing methods. Since any study of this type has some limitations, the summary and conclusion chapter will explore the implications and the limitations of the data. But, the data clearly reject the first hypothesis set down, that of no price difference between methods of marketing and markets. Clearly, on the basis of this study, the grade and yield method of selling would return the producer the greatest net dollars for his hogs.

SUMMARY AND CONCLUSIONS

One cannot assume that the hog price differentials found between markets, in this study, can apply identically to all similar Iowa markets. Some of the factors affecting a particular market are peculiar to only that market. Any generalization made about expected prices at specific markets would be extremely tenuous.

A hypothesis generally made by marketing research workers and marketing economists is that the transportation cost, between one central terminal market and another, would account for most of the price differences. That is, the price difference between terminal markets could not be any larger than the costs of transporting hogs from one market to the other. In this study, two central markets, Sioux City (A_1) and Omaha (A_2) were compared to determine the price difference between them. One would assume, as stated above, that there should be no difference between them. Temporarily the price at one market could be above another but no higher than the cost of transporting hogs from one market to another. Over the long run, the market prices of the two should be equal.

There are some basic factors which cause these two markets to have identical or nearly identical prices:

1. The terminal markets are an integral part of the national market.

2. The concentration of hog producers around each market are approximately the same.
3. The number of packers buying on each terminal are practically the same.
4. Many of the packer buyers patronize both markets.
5. The method of pricing the hogs is the same for both markets, they both use private treaty.
6. The feeding and weighing on each market is similar.
7. The government reporters collect prices and supplies of hogs for both markets and relay the information to the news media, (i.e., radio, television and newspaper).

The data obtained from this research study supports the general hypothesis stated earlier; there was no significant price difference between the two terminal markets.

Another type or method of marketing used in this study was interior packing plants buying hogs on a carcass grade and yield basis. These plants are located at Waterloo (B_3) and Des Moines (B_6).

There was found in this study no significant price difference between the two carcass grade and yield buying plants.

One might raise the question, "Is there any reason to expect that the prices paid for hogs by these markets should be similar?" Most packing plants, buying on a carcass grade and yield method use wholesale prices to determine the value

of hogs purchased. A packer estimates the yield of saleable meat from prior experience gained by breaking hog carcasses down and multiples this by the wholesale price. Therefore, if the yield estimations are similar, the prices paid should be similar. One can easily recognize that the only variable in estimating value is yield estimation, because wholesale prices are reported daily and available to the entire meat trade. The data obtained from this study is consistant with the results one would expect.

The other type of hog buying method and/or market examined in this study was direct packer purchases by live evaluation. The two packing plants used for this analysis were located at Fort Dodge (C_4) and Cedar Rapids (C_5). These two buying firms did not pay identical prices, that is a price difference was found between these two plants. There are many reasons why the prices were not similar.

The essential reasons why packing plants may not pay identical prices were discussed in the theory chapter and will not be examined fully in this chapter.

The data obtained for this study could also be used to determine price responsiveness of markets, as well as price differences.

Price Differences Between Markets

The average price differences found between similar markets are as follows (using market weight price):

$A_1 - A_2 = \$0.1501 - \$0.1501 = 0$

$B_3 - B_6 = \$0.1555 - \$0.1555 = 0$

$C_4 - C_5 = \$0.1435 - \$0.1513 = -\$0.0078$/pound of hog
or \$0.78/cwt.

As mentioned earlier there were price differences found between types of markets and/or different methods of buying hogs. The average price differences found between methods of marketing and/or markets are as follows:

$A - B = \$0.1501 - \$0.1555 = -\$0.0054$/pound per hog
or - \$0.54/cwt.

$A - C_4 = \$0.1501 - \$0.1435 = \$0.0066$/pound of hog
or \$0.66/cwt.

$A - C_5 = \$0.1501 - \$0.1513 = -\$0.0012$/pound of hog
or - \$0.12/cwt.

$B - C_4 = \$0.1555 - \$0.1435 = \$0.0120$/pound of hog
or \$1.20/cwt.

$B - C_5 = \$0.1555 - \$0.1513 = \$0.0042$/pound of hog
or \$0.42/cwt.

The B markets or carcass grade and yield buying markets clearly paid more for hogs than did the other markets. Producers marketing their hogs at B type markets could gain an additional \$0.54 for each hundred pounds of hogs sold.

Price Responses

In addition to obtaining the preceding data, data were obtained on the price responsiveness of markets. The price

responsiveness of markets might provide producers with additional knowledge to assist them in selecting a particular market. The method used to determine price response was to compare composite prices with actual prices received. The price responses found for each market are as follows:

Where D = Difference between the average composite of the total markets and the composite price of a particular shipment.

$$A = (0.1501) + (0.8064)(D)$$

$$B = (0.1555) + (0.9164)(D)$$

$$C_4 = (0.1435) + (1.3217)(D)$$

$$C_5 = (0.1513) + (0.9045)(D)$$

The last terms in the above equations indicate the price responsiveness of a market.

The most responsive market was C_4 (1.3217), the least responsive was A (0.8064). Although the B market was not the most price responsive (0.9164) its response was fairly high. Despite the fact that B's price response was lower, its general price level was well above the prices of the other markets. Only at extremely high hog price levels did C_4 pay more for hogs, than did the A, B or C_5 markets.

As discussed in the analysis chapter, there was no response difference between B_3 and B_4 or A_1 and A_2, but there was a response difference between C_4 and C_5 (both purchased hogs on a live basis). Why was C_4 more price responsive

than C_5?

One obvious reason must be that the factors affecting these two markets, when buying hogs, are not identical. Some of the factors affecting packing plants buying prices were discussed in the theory chapter, but additional factors will be examined in this chapter.

Live hog market prices are derived from retail prices through the wholesaler and finally through the packing plants. Live prices are a reflection of consumer demand for pork and all live prices must be a reflection of this demand. A local live market is a part of the national market. Just because a local market is interrelated with the national market does not preclude that all local markets must have identical prices. Each packing plant (local market) has some of the features peculiar to oligopsonies or monopsonies. A market containing these features could have prices which depart from the national market derived prices.

It would appear that C_4 has a peculiar supply situation, one that is different from the other markets, because its price patterns were considerably different than the prices of the other markets. C_4's prices were not only more responsive, but the price level of C_4 except for extremely high composite prices, was consistently below the price level of most other markets. When the general price level was low (i.e., supply relatively larger) C_4's price discounts on light hogs were much larger than the other

markets. Apparently C_4 did not want these lighter hogs and did not feel that the heavy discounting would affect their total receipts. When the supplies of hogs were large (i.e., prices lower), C_4 did not apply a large price discount on the light hogs. At this level of supply, C_4's prices were very close to the prices of other markets.

The examination of C_4's reaction, however, should not ignore the fact that C_4 does buy hogs by other methods. Packers also purchase hogs using carcass grade and yield for evaluation. It may be that C_4 does not have identical response curves with all buying methods.

The C_5 market was not as price responsive as was C_4. Although C_5 did change prices as supplies changed, it did not change prices as rapidly as did C_4. What might be the factors which contribute to the different price reactions of these two markets?

C_5's only method of purchasing hogs was live evaluations of the hogs. This may partially explain C_5's pricing policy during supply or general price level changes. Since C_5 used only one method of buying, C_5's hog buying personnel might have felt drastic price changes would reduce receipts. C_4 on the other hand, might have felt they were forced to be competitive when buying on carcass basis (because the larger, more knowledgeable producers sell hogs this way), but not for

the live evaluated hogs. They could offset the higher prices paid on hogs bought by the carcass basis with the hogs bought on a live basis. If the two buying methods used by C_4 could have been combined, the response of C_4 might have been very similar to the other markets. C_5 and C_4's individual or peculiar supply area might have caused the price pattern discrepency between these two markets. If this were true, it would seem that C_5 has more competitors (competitors for purchasing hogs) at all supply levels than does C_4. C_5 would not have the locational advantage that C_4 enjoys. The producers located around C_4's plant must be attracted to that plant for reasons other than price, or it might be that C_4's local producers are not aware of the available market alternatives. However, it does not appear reasonable that the bulk of the producers surrounding C_4 should be any less aware of other market alternatives than are the C_5 producers.

What previous theory would adequately explain why the terminals or A markets are the least responsive to price change? Normally, one would expect those markets with the most monopsonistic or oligopsonistic features to be the markets which respond the least. The terminal markets or the packing plants buying on the terminal markets do not seem to possess the necessary criteria to have more monopsony or oligopsony features than packing plants located off the

central terminal market.[1] It could be as some people have maintained, that the function previously played by terminal markets has declined to a point where only surplus hogs are shipped to these markets. That is, hogs not needed by the interior packers are shipped to the terminal markets. If this were true, it would mean that when hog supplies were low, terminal markets would not be bidding competitively for hogs, but during larger supply periods, they would appear relatively more aggressive. What the preceding hypothesis implied was that packers who buy on the terminal markets do not adjust hog prices as much as other packing plants. When prices rise too high, they refrain from bidding and after the price level lowers, they move back into the market.

However, it must be made clear that packing plants purchasing hogs on the terminal markets pay greater prices than

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[1]When reference is made to packing plants, it is not meant to exclude terminal yards, rather terminal yards are included. The prices paid for hogs at the terminal markets are the result of packing plants buying on that market. If terminal yards do not pay competitive prices, it is because those plants buying on the terminal markets cannot or do not desire to compete with the packing plants not buying on the terminal yards. The terminal yards are not a buying agency, they do not determine competition, they simply provide a mechanism that is designed to implement competition. It is those packing plants who buy on that market determine the price.

It is true that any packing plant can purchase livestock on the terminal markets, but once interior packing plants have hired buyers and have supplied them with proper buying equipment (cars, radios, etc.) they have to compare the marginal cost of procuring livestock locally with the cost of obtaining them from the terminal yards. (Cont. next page)

those recorded in the study. In order to derive the producers net price, it was necessary to deduct the marketing charges assessed by the terminal marketing agencies from the gross price. However, packing plants, buying hogs at the terminal market, must pay full price for their hogs at prices which include marketing charges. The average marketing charge for all the hogs marketed in this study was 50 cents per hundred pounds of live hog. If this marketing charge is added to the terminal market price as shown in Figure 8, one readily can see even at the lowest level of prices, the price paid by packers purchasing at the terminal yards was more than that paid by packers buying under the rail grade system. At the mean composite price, the price paid for hogs by packing plants buying at the terminal yards was $15.50 per hundred pounds. Whereas the carcass grade and yield buying

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(Footnote continued) Procuring livestock by packers on the terminal market does incur some costs such as putting a buyer on that market as well as the cost of transporting the hogs from the terminal market to the packing plant. If the distance from the terminal market to the packing plant is large, the transportation and weight loss costs can be an important factor. The packer might be able to pay locally 20 to 50 cents over the terminal market price to procure sufficient supplies, and still be economically sound. Some of the direct procurement of hogs by packing plants is done by independent buyers hired on a commission basis.

This portion of a packers buying operation is completely flexible, the plants incur no operating losses when not purchasing through these sources. So with this type of buying operation, the packer can choose the most economical method of buying his hogs without having to account for fixed costs.

firms paid $15.55 per hundred pounds, only .05 per hundred pounds higher. These figures point out very clearly why terminal located packing plants have had trouble surviving. They have not only been forced to pay competitive prices but many of the terminal located plants are older and more out-of-date plants. The irony of this situation is that farmers receive less from hogs sold at terminal markets not only but that packers who are obtaining supplies from terminal markets are paying competitive prices. The lower price received by farmers from terminal market sold hogs has led many farmers away from the terminal markets and has reduced the supply of hogs available to the terminal based plant, causing per unit operating costs to rise.

Reasons for Price Differences

This study does not have sufficient data to determine the basic causes of the various market price levels. It was designed only to measure the price differentials between markets.

The fact that the carcass grade and yield market prices are from (the relevant range used in this study) 40 to 45 cents per hundred pounds above the C_5, the next highest market, and from 40 to 65 cents per hundred pounds above the terminal market raises one specific question. Why do packers, when buying on a carcass basis, pay higher prices for hogs

than when using other methods of purchasing? The following list contains some of the possible reasons for the price discrepencies.

1. Packers are unaware that they are paying more when they are purchasing hogs by the carcass.
2. The total number of hogs purchased by the grade and yield method is only a small proportion of the total hogs purchased, so packers can justify the higher price by charging the cost off to public relations or good will.
3. The cost of procurement using the other buying methods is higher so that it is economically feasible to pay higher prices in order to eliminate buying costs.
4. The reason given by most packing plants for paying higher for hogs bought on a carcass basis is that the packer can pay more because uncertainty is eliminated. Packing plant personnel say the packer is able to estimate the value of meat purchased from producers. Most marketing studies on buying methods indicate that grade and yield evaluation is more accurate than live evaluation (11).

Many packers contend that the higher value paid for carcass graded animals can be justified because carcass buying reduces uncertainty in estimating the true value of the

animal. There may be a few individual cases where this is true, especially for small packing plants, where the numbers of hogs purchased are small. The author's contention however is that it does not apply to relatively large packing plants such as those used in this study. The number of hogs handled by these larger packing plants can amount to over 2,000 hogs a day, or over 600,000 hogs a year. The uncertainty created by estimating yields from the live hog would be very small, with larger numbers of hogs purchased. Probability values can be established on yields of meat from hogs and accurate estimations of yields from a live evaluation can be made. Any purported uncertainty to which a probability can be estimated is no longer a uncertainty.

Another factor which eliminates some of the uncertainty when buying hogs, via the carcass grade and yield method, is that when a packer uses this method, the packer does not have to assume any loss due to condemnation, although in many cases packers do assume part of the loss. If the animal, or a portion of the carcass, is deemed unfit for human consumption, the producer assumes the loss because the value of a hog is determined by the estimated yield of meat from the carcass as it hangs in the cooler. But again, with large numbers of hogs handled probabilities can be attached to the loss and thereby accounted for by reducing price.

The limitations of this study or any study, which attempts to determine the price patterns of an industry, is that once price inconsistencies are discovered, the industry, in this case packing plants, can be expected to move immediately to correct the price inconsistencies.

If producers are convinced, from this study, that they will receive higher net returns by selling their hogs the carcass method, packing firms aware of this will adjust their carcass prices lower. Packing plants can accomplish the adjustment by either increasing their processing charge or lowering prices. However, if there is an economically sound reason for packing plants to have different prices for different methods of buying, then all packing firms will have to adjust their buying prices 40 to 60 cents per cwt. upward to those found using the carcass method. If carcass buying packing plants used in this study included all their costs when deducting processing charges, then carcass buying is the most accurate method of determining the derived live hog prices. All other methods of buying, unless drastically revised, will be obsolete and those packing plants without carcass buying, or an equivalent live buying price, will be unable to procure sufficient hogs to maintain necessary plant volume. The inefficiencies in the other systems of buying will have to be eliminated. The change will come about only if producers react to this new knowledge. Until the results

obtained from this study and others are acted upon by producers the familiar marketing patterns will continue to exist for a considerable time.

If the grade and yield buying price does not represent the true competitive situation, packing plants will quickly adjust carcass grade and yield buying prices lower before they are forced out of business due to losses incurred from over-pricing their raw product.

If the rail grade or carcass grade and yield price represents the true competitive hog price, then Iowa hog producers could annually increase their income by $18 million by using this method of marketing, ceteris paribus. Iowa producers annually sell over 4.5 billion pounds of live pork. They could obtain a net gain of 40 cents per hundred pounds by selling carcass grade and yield, assuming there is no additional transportation cost and that all Iowa grade and yield buying plants would pay the same price as those found in this study.

Further Research

Additional hog price studies should be made using the design and method of analysis developed for this study. A study should be made comparing a larger number of packing plants using the carcass grade and yield method of buying. Even though this study showed no statistical difference between two packing plants buying on a carcass basis, it does

not necessarily prove that there is no difference between each and every plant using the carcass method of buying. One can generalize about price differences from this study, but the generalizations may not be accurate in all cases. Each packing plant has its own method of estimating yield. Therefore, the variation in yield estimation between plants might be large enough to create a hog price difference between carcass buying markets.

A study should be made to determine if there are any price differences between methods of buying when the grades of hogs are different. A widely accepted theory by marketing economists is that terminal markets pay more for lower quality hogs than do other markets. Many marketing specialists contend that the interior or direct buying plants select, out of an area, the high yielding, high grading hogs. They do this by paying premium prices for the better hogs, thereby leaving the lower grade hogs to be marketed at the terminal markets. The terminal markets, because of this situation, are forced, if they are to receive any hogs, to pay higher than normal for the lower quality hogs. The terminals contend that direct buyers discount highly the poorer quality hogs. A further study of this problem could be accomplished by separating hogs into standard quality ranges and marketing the various grades to different markets.

If price differences do exist between markets in Iowa, as

found in this study, then a continual study should be made ascertaining which market is paying the lower or higher prices to producers.

A study should be made to determine how each Iowa hog market responds to price changes. All packing plants, ideally should have identical price response curves, that is, price responses should be identical if producers are informed of price responses and price differentials. The price deviations should not be larger than the cost of transporting hogs from one market to another. Clearly, the price differences found in this study were much larger than the transportation cost.

Producers of Iowa market a majority of their hogs directly to packing plants. Studies should be made to determine the buying practices used by direct buyers. Many buying practices presently being used by hog buying firms, as reported by producers, clearly are not to the advantage of the producer. These buying practices should be understood by the producer before he markets his hogs.

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The final tribute must go to my wife, Marvel, for her patience and understanding during the course of this study.

APPENDIX A

Definitions of Variables Used in Analyzing Marketing Periods Separately

Dependent variable

X_1 = Market Weight Price

$$\left(\frac{\text{Total value of shipment - Marketing charge}}{\text{Market weight of hogs}}\right)$$

X_6 through X_{10} = dummy variables for blocks of shipments

X_{11} = Difference between live sort markets and terminal markets ($A = 1$; $C = -1$)

X_{12} = Difference between terminal markets and carcass grade and yield markets ($A = -1$; $B = 1$)

X_{13} = Difference between the two terminal markets ($A_1 = 1$; $A_2 = -1$)

X_{14} = Difference between the two carcass grade and yield markets ($B_3 = 1$; $B_6 = -1$)

X_{15} = Difference between the two live sort markets ($C_4 = 1$; $C_5 = -1$)

X_{17} = A time trend variable between the terminal markets and the live sort markets

X_{18} = A time trend variable between the terminal markets and the carcass grade and yield markets

Table 17. ANOV, R^2, standard error and F ratio for first marketing period

Source	D.F.	Sum squares	Mean square
Regression	12	5.7446	.4787
Residual	9	.0641	.0071
Total	21	5.8087	

F ratio = 67.21 Multiple R^2 = 0.989

Standard error = 0.0844

Table 18. Value of a, b values and standard errors of b for first marketing period

a = $15.96 per hundred pounds of hog

b subscript designation	b value	standard error of b
6	0.79**	0.048
7	0.09*	0.043
8	0.18*	0.043
9	-0.05	0.043
10	-0.12*	0.044
11	-0.29**	0.028
12	0.50**	0.029
13	-0.05	0.037
14	0.13**	0.035
15	-0.08*	0.031
17	0.04**	0.008
18	0.02*	0.010

Table 19. ANOV, R^2, standard error and F ratio for first marketing period

Source	D.F.	Sum squares	Mean square
Regression	10	5.3263	0.5326
Residual	11	0.4824	0.0439
Total	21	5.8087	

F ratio = 12.15 R^2 = 0.917

Standard error = 0.209

Table 20. Value of a, b values and standard errors of b for first marketing period

a = $15.98 per hundred pounds of hog

b subscript designation	b value	Standard error of b
6	0.82**	0.104
7	0.04	0.103
8	0.16	0.105
9	-0.10	0.104
10	-0.23	0.104
11	-0.36**	0.067
12	0.50**	0.071
13	-0.07	0.090
14	0.15	0.086
15	-0.10	0.077

Table 21. ANOV, R^2, standard error and F ratio for second marketing period

Source	D.F.	Sum squares	Mean square
Regression	12	7.0409	0.5867
Residual	11	1.1086	0.1008
Total	23	8.1496	

F ratio = R^2 =

Standard error =

Table 22. Value of a, b values and standard errors of b for second marketing period

a = $14.22 per hundred pounds of hog

b subscript designation	b value	standard error of b
6	-0.04	0.158
7	0.25	0.154
8	-0.01	0.155
9	0.22	0.154
10	-0.25	0.157
11	0.09	0.095
12	0.35**	0.095
13	0.03	0.122
14	0.08	0.122
15	-0.61**	0.121
17	-0.04	0.028
18	0.02	0.029

Table 23. ANOV, R^2, standard error and F ratio for second marketing period

Source	D.F.	Sum squares	Mean square
Regression	10	6.8745	0.6875
Residual	13	1.2752	0.0981
Total	23	8.1497	

F ratio = 7.00 R^2 = 0.844

Standard error = 0.313

Table 24. Value of a, b values and standard error of b for second marketing period

a = $14.21 per hundred pounds of hog

b subscript designation	b value	standard error of b
6	-0.06	0.151
7	-0.24	0.151
8	0.01	0.151
9	0.23	0.151
10	-0.22	0.151
11	0.08	0.093
12	0.36**	0.093
13	<0.01	0.119
14	0.07	0.119
15	-0.62**	0.119

APPENDIX B

Explanation of Variables Used in Analyzing Weight Loss to Market

Dependent variable X_2 = the market weight of hogs

X_4 - X_{14} = dummy variables for weeks, subscripts designate the following: X_4 = first block shipped, X_5 = second block shipped, $\cdots$, X_{14} = twelfth block shipped.

X_{15} = same as X_{17} in text page 79.

X_{16} = same as X_{18} in text page 79.

X_{17} = same as X_{19} in text page 79.

X_{18} = same as X_{20} in text page 79.

X_{19} = same as X_{25} in text page 79.

X_{20} = same as X_{24} in text page 80.

X_{21} = X_{20} times X_{15}

X_{22} = X_{20} times X_{16}

X_{23} = X_{20} times X_{17}

X_{24} = X_{20} times X_{18}

X_{25} = X_{20} times X_{19}

Table 25. ANOV, R^2, standard error and F ratio of market weight analysis

Source	D.F.	Sum squares	Mean square
Regression	22	113,312,920	5,150,580
Residual	23	17,912,240	778,790
Total	45	131,225,160	

F ratio = 6.61 Standard error = 882.49

R^2 = 0.863

Table 26. Value of a, b values, standard errors of b and T values for weight loss analysis

a = 9032.3 pounds

b subscript	b value	standard error b
4	221.6	1207.9
5	598.9	1466.2
6	88.8	817.0
7	497.7	912.9
8	1923.4	3652.8
9	876.3	4309.4
10	853.4	3215.4
11	518.6	2484.8
12	627.8	2873.2
13	80.7	1152.5
14	750.3	2790.2
15	175.4	177.4
16	184.1	97.3
17	113.5	257.1
18	173.6	251.4
19	255.5	237.2
20	1.6	1.9
21	0.1	0.1
22	0.2	0.1
23	0.1	0.2
24	0.2	0.2
25	0.2	0.2

APPENDIX C

Table 27. Data derived from marketing study

	Shipment No.	No. Head	Initial wt.	Mkt. wt.	Gross value ship	Other expenses			
						Yardage	Corn and bedding	Inspection yard	Meat board
			lb.	lb.	$	$	$	$	$
8/26/63									
Fort Dodge	1	41	8447	8300	1390.55				.2
Sioux City	1	42	8800	8405	1398.63	14.28	6.30	.86	.2
Cedar Rapids	1	43	8962	8785	1493.45				.2
Omaha	1	43	8796	8440	1433.50	17.20	4.75	.65	.2
8/29/63									
Omaha	2	50	10198	9870	1609.46	20.00	2.85	8.20	.3
Waterloo	2	50	10052	9925	1646.13				.3
Des Moines	2	50	10114	9965	1639.17				.3
Cedar Rapids	2	50	9999	9795	1577.70				
9/3/63									
Waterloo	3	47	9566	9680	1620.06				.3
Fort Dodge	3	48	9861	9820	1570.07				.3
Des Moines	3	47	9677	9755	1601.29				.3
9/4/63									
Des Moines	4	48	9777	9425	1536.45				.3
Sioux City	4	48	9773	9315	1513.68	16.32	5.10	1.02	20.3
Fort Dodge	4	48	9844	9465	1471.10				.3
Cedar Rapids	4	48	9737	9340	1461.61				.3
9/9/63									
Cedar Rapids	5	55	11293	10770	1673.32				.3
Waterloo	5	55	11331	10860	1800.00				.3
Omaha	5	55	11242	10645	1730.94	22.00	5.70	.82	.3
Fort Dodge	5	55	11247	10840	1663.89				.3
9/16/63									
Omaha	6	56	11578	11150	1744.97	22.40	8.40	.84	.3
Des Moines	6	56	11632	11235	1750.88				.3

r expenses rn nding	Inspection yard	Meat board	Comm.	Total other	Trucking and ins.	Net return TG-TO=TN	Composite price	Initial wt.	Mkt. wt.
	$	$	$	$	$	$	¢/lb.	¢/lb.	¢/lb.
		.27		.27	9.75	1390.28	.15932	.16458	.16750
30	.86	.28	18.55	40.27	39.92	1358.36	.15661	.15362	.16086
		.29		.29	54.40	1493.16	.15992	.16661	.16996
75	.65	.28	18.52	41.41	42.38	1392.09	.15631	.15728	.16392
85	8.20	.34	23.09	54.48	50.48	1554.98	.15475	.15140	.15643
		.33		.33	12.00	1645.80	.15359	.16373	.16582
		.33		.33	22.92	1638.84	.15440	.16204	.16445
					33.29	1577.70	.15357	.15778	.16100
		.31		..31	12.00	1619.75	.15258	.16935	.16732
		.31		.31	9.75	1569.76	.15688	.16263	.15985
		.31		.31	22.43	1600.98	.15409	.16544	.16411
		.31		.31	21.67	1536.14	.15036	.15711	.16298
10	1.02	20.32	20.95	43.71	50.56	1469.97	.15010	.14952	.15687
		.32		.32	9.75	1470.78	.15225	.14940	.15539
		.32		.32	29.88	1461.29	.15165	.15007	.15645
		.39	66.34	.39	66.34	1672.93	.14921	.14814	.15533
		.36		.36	12.00	1799.64	.15018	.15882	.16571
70	.82	.36	23.20	52.08	54.66	1678.86	.14941	.14826	.15656
		.36		.36	9.75	1663.53	.14965	.14791	.15346
40	.84	.38	23.59	55.61	33.80	1689.36	.14484	.14494	.15051
		.37		.37	25.84	1750.51	.14685	.15049	.15581

Table 27. Data derived from marketing study

	Shipment No.	No. Head	Initial wt.	Mkt. wt.	Gross value ship	Other expenses			
						Yardage	Corn and bedding	Inspection yard	Mea board
			lb.	lb.	$	$	$	$	$
8/26/63									
Fort Dodge	1	41	8447	8300	1390.55				.2
Sioux City	1	42	8800	8405	1398.63	14.28	6.30	.86	.2
Cedar Rapids	1	43	8962	8785	1493.45				.2
Omaha	1	43	8796	8440	1433.50	17.20	4.75	.65	.2
8/29/63									
Omaha	2	50	10198	9870	1609.46	20.00	2.85	8.20	.3
Waterloo	2	50	10052	9925	1646.13				.3
Des Moines	2	50	10114	9965	1639.17				.3
Cedar Rapids	2	50	9999	9795	1577.70				
9/3/63									
Waterloo	3	47	9566	9680	1620.06				.3
Fort Dodge	3	48	9861	9820	1570.07				.3
Des Moines	3	47	9677	9755	1601.29				.3
9/4/63									
Des Moines	4	48	9777	9425	1536.45				.3
Sioux City	4	48	9773	9315	1513.68	16.32	5.10	1.02	20.3
Fort Dodge	4	48	9844	9465	1471.10				.3
Cedar Rapids	4	48	9737	9340	1461.61				.3
9/9/63									
Cedar Rapids	5	55	11293	10770	1673.32				.3
Waterloo	5	55	11331	10860	1800.00				.3
Omaha	5	55	11242	10645	1730.94	22.00	5.70	.82	.3
Fort Dodge	5	55	11247	10840	1663.89				.3
9/16/63									
Omaha	6	56	11578	11150	1744.97	22.40	8.40	.84	.3
Des Moines	6	56	11632	11235	1750.88				.3

er expenses									
orn and dding	Inspection yard	Meat board	Comm.	Total other	Trucking and ins.	Net return TG-TO=TN	Composite price	Initial wt.	Mkt. wt.
$	$	$	$	$	$	$	¢/lb.	¢/lb.	¢/lb.
		.27		.27	9.75	1390.28	.15932	.16458	.16750
.30	.86	.28	18.55	40.27	39.92	1358.36	.15661	.15362	.16086
		.29		.29	54.40	1493.16	.15992	.16661	.16996
.75	.65	.28	18.52	41.41	42.38	1392.09	.15631	.15728	.16392
.85	8.20	.34	23.09	54.48	50.48	1554.98	.15475	.15140	.15643
		.33		.33	12.00	1645.80	.15359	.16373	.16582
		.33		.33	22.92	1638.84	.15440	.16204	.16445
					33.29	1577.70	.15357	.15778	.16100
		.31		..31	12.00	1619.75	.15258	.16935	.16732
		.31		.31	9.75	1569.76	.15688	.16263	.15985
		.31		.31	22.43	1600.98	.15409	.16544	.16411
		.31		.31	21.67	1536.14	.15036	.15711	.16298
.10	1.02	20.32	20.95	43.71	50.56	1469.97	.15010	.14952	.15687
		.32		.32	9.75	1470.78	.15225	.14940	.15539
		.32		.32	29.88	1461.29	.15165	.15007	.15645
		.39	66.34	.39	66.34	1672.93	.14921	.14814	.15533
		.36		.36	12.00	1799.64	.15018	.15882	.16571
.70	.82	.36	23.20	52.08	54.66	1678.86	.14941	.14826	.15656
		.36		.36	9.75	1663.53	.14965	.14791	.15346
.40	.84	.38	23.59	55.61	33.80	1689.36	.14484	.14494	.15051
		.37		.37	25.84	1750.51	.14685	.15049	.15581

Table 27. (Continued)

	Shipment No.	No. Head	Initial wt.	Mkt. wt.	Gross value ship	Other expenses			
						Yardage	Corn and bedding	Inspection yard	Meat board
			lb.	lb.	$	$	$	$	$
2/27/64									
Omaha	1	39	7680	7280	1099.28	15.60	5.28	.78	.26
Des Moines	1	39	7673	7420	1103.65				.26
Cedar Rapids	1	39	7632	7320	1037.98				
3/2/64									
Sioux City	2	40	8074	7615	1123.21	13.60	3.27	.81	.27
Waterloo	2	40	8062	7760	1175.03				.26
Des Moines	2	40	8068	7695	1138.64				.27
Cedar Rapids	2	40	7987	7660	1110.70				.27
3/5/64									
Sioux City	3	40	7848	7440	1116.41	13.60	6.40	.81	.27
Omaha	3	40	7818	7395	1126.05	16.00	5.42	.80	.27
Waterloo	3	40	7832	7475	1090.90				.26
Fort Dodge	3	40	7829	7500	967.19				.26
3/9/64									
Omaha	4	45	8800	8370	1268.05	18.00	4.50	.90	.30
Waterloo	4	45	8784	8455	1254.38				.30
Des Moines	4	45	8752	8255	1238.82				.29
Fort Dodge	4	45	8768	8345	1096.80				.30
3/12/64									
Sioux City	5	40	7852	7510	1113.30	13.60	6.80	.81	.27
Waterloo	5	40	7854	7650	1091.11				.26
Cedar Falls	5	40	7876	7625	1105.62				.26
Fort Dodge	5	40	7897	7660	1000.59				.26
3/18/64									
Sioux City	6	54	10783	10415	1521.21	18.36	4.13	1.08	.36
Omaha	6	54	10700	10335	1472.73	21.60	6.30	1.58	.36
Des Moines	6	54	10799	10680	1540.04				.36
Cedar Rapids	6	54	10797	10655	1555.63				.36
Totals		2115			63220.73	258.88	81.92	20.98	13.45

Other expenses									
Corn and bedding	Inspection yard	Meat board	Comm.	Total other	Trucking and ins.	Net return TG-TO=TN	Composite price	Initial wt.	Mkt. wt.
$	$	$	$	$	$	$	¢/lb.	¢/lb.	¢/lb.
5.28	.78	.26	17.74	39.66	41.34	1059.62	.13496	.13685	.14437
		.26		.26	17.06	1103.39	.13478	.14386	.14877
					23.42	1037.98	.13441	.13600	.14180
3.27	.81	.27	17.75	35.70	37.66	1087.51	.13544	.13380	.14375
		.26		.26	12.00	1174.97	.13595	.14574	.15141
		.27		.27	17.69	1138.37	.13508	.14116	.14800
		.27		.27	38.30	1110.43	.13468	.13902	.14496
6.40	.81	.27	17.75	38.83	44.40	1077.58	.13253	.13638	.14386
5.42	.80	.27	18.15	40.64	42.07	1085.41	.13189	.13770	.14558
		.26		.26	12.00	1090.64	.13243	.13925	.14590
		.26		.26	9.75	966.97	.13256	.12351	.12893
4.50	.90	.30	20.20	43.90	46.66	1224.15	.13005	.13808	.14517
		.30		.30	12.00	1254.08	.13371	.14276	.14832
		.29		.29	19.38	1238.53	.13224	.14151	.15003
		.30		.30	9.75	1096.50	.13341	.12505	.13139
6.80	.81	.27	17.75	39.23	44.75	1074.07	.13415	.13587	.14205
		.26		.26		1090.85	.13333	.13986	.14259
		.26		.26	30.50	1105.36	.13276	.13647	.14096
		.26		.26	9.75	1000.33	.13319	.12667	.13059
4.13	1.08	.36	23.84	47.77	61.80	1473.44	.13315	.13574	.14054
6.30	1.58	.36	23.89	53.73	58.39	1419.12	.13189	.13151	.13615
		.36		.36	24.56	1539.68	.13224	.14257	.14416
		.36		.36	42.98	1555.27	.13267	.14404	.14597
31.92	20.98	13.45	305.92	681.15	1336.35	62539.94			